REPLACING THE CAPACITORS IN R390A

Date: Thu, 03 Sep 1998 08:58:24 -0500
From: "Dr. Gerald N. Johnson, P.E." <geraldj@ames.net>
Subject: Re: [R-390] More brown beauties... Terminology???

Brown and black beauties are oil filled molded paper capacitors from the 50s and 60s that tend to get leaky or very leaky with age, 10 years or so. Orange Drops are polyester film capacitors made by Sprague that are truly orange. Radial instead of axial leads, but tougher than most any abuse I've been able to give them including a pass through the clothes washer and dryer.

Nolan's R-390A/URR Master Capacitor List

Revision 0.4 BETA **(11/29/99)**

nlee@gs.verio.net

This list is still "BETA". As a result has NOT been checked as closely for errors as usual. Please drop me a message if I left anything out or if you spot an error and I'll correct it and re-post. Thanks, nolan

\- ----------
\- -----Main Chassis (front and rear panel, etc.)-----
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C101 0.22mf 100 WVDC 20% paper
C102 5000pf 1000 WVDC 15% ceramic
C103 50mf 50 WVDC ??% electrolytic industry # CE64C500G (1)
C104 0.068mf ??? WV?C ??% paper (inside of line filter)
C105 0.068mf ??? WV?C ??% paper (inside of line filter)
C106 0.068mf ??? WV?C ??% paper (inside of line filter)
C107 0.068mf ??? WV?C ??% paper (inside of line filter)

(1) This is the bathtub style capacitor mounted below the line filter on the rear panel. It is NOT an oil filled paper cap even though it looks like one. Watch the polarity.

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\- -----RF Amplifier Subchassis-----
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C201A 3-12pf 350 WVDC NPO ceramic trimmer (inside of T201)
C201B 8-50pf 350 WVDC N750 ceramic trimmer (inside of T201)
C202 7pf 500 WVDC .25pf ceramic (inside of T201)
C203 330pf 500 WVDC 2% mica (inside of T201)

C204 120pf 500 WVDC 2% mica (inside of T201)
C205A 3-12pf 350 WVDC NPO ceramic trimmer (inside of T202)
C205B 8-50pf 350 WVDC N750 ceramic trimmer (inside of T202)
C206 7pf 500 WVDC .25pf ceramic (inside of T202)
C207 120pf 500 WVDC 2% mica (inside of T202)
C208 75pf 500 WVDC 2% mica (inside of T202)
C209A 3-12pf 350 WVDC NPO ceramic trimmer (inside of T203)
C209B 8-50pf 350 WVDC N750 ceramic trimmer (inside of T203)
C210 7pf 500 WVDC .25pf ceramic (inside of T203)
C211 36pf 500 WVDC 2% mica (inside of T203)
C212 39pf 500 WVDC 2% mica (inside of T203)
C213A 3-12pf 350 WVDC NPO ceramic trimmer (inside of T204)
C213B 5-25pf 350 WVDC NPO ceramic trimmer (inside of T204)
C214 7pf 500 WVDC .25pf ceramic (inside of T204)
C215 100pf 500 WVDC 2% mica (inside of T204)
C216 24pf 500 WVDC 5% mica (inside of T204)
C217A 3-12pf 350 WVDC NPO ceramic trimmer (inside of T205)
C217B 3-12pf 350 WVDC NPO ceramic trimmer (inside of T205)
C218 7pf 500 WVDC .25pf ceramic (inside of T205)
C219 5pf 300 WVDC .5pf mica (inside of T205)
C220 12pf 500 WVDC 5% mica (inside of T205)
C221A 3-12pf 350 WVDC NPO ceramic trimmer (inside of T206)
C221B 1.5-7pf 350 WVDC NPO ceramic trimmer (inside of T206)
C222 7pf 500 WVDC .25pf ceramic (inside of T206)
C223 18pf 500 WVDC 5% mica (inside of T206)
C224 5pf 300 WVDC .5pf mica (inside of T206)
C225A 7-80pf 800 WVAC 4pf variable (front half of antenna trimmer cap)
C225B 6-26pf 800 WVAC 2pf variable (rear half of antenna trimmer cap)
C226 5000pf 1000 WVDC 15% ceramic
C227 0.047mf 100 WVDC 20% paper (4)(z)
C228 1pf 500 WVDC .25% ceramic
C229 5000pf 1000 WVDC 15% ceramic
C230-1 8-50pf 350 WVDC N750 ceramic trimmer (inside of Z201-1)(z)
C230-2 8-50pf 350 WVDC N750 ceramic trimmer (inside of Z201-2)(z)
C231-1 160pf 500 WVDC 2% mica (inside of Z201-1)(z)
C231-2 160pf 500 WVDC 2% mica (inside of Z201-2)(z)
C232-1 2400pf 300 WVDC 2% mica (inside of Z201-1)(z)
C232-2 2400pf 300 WVDC 2% mica (inside of Z201-2)(z)
C233-1 8-50pf 350 WVDC N750 ceramic trimmer (inside of Z202-1)
C233-2 8-50pf 350 WVDC N750 ceramic trimmer (inside of Z202-2)
C234-1 1800pf 500 WVDC 2% mica (inside of Z202-1)
C234-2 1800pf 500 WVDC 2% mica (inside of Z202-2)
C235-1 2400pf 300 WVDC 2% mica (inside of Z202-1)
C235-2 2400pf 300 WVDC 2% mica (inside of Z202-2)

C236-1 8-50pf 350 WVDC N750 ceramic trimmer (inside of Z203-1)
C236-2 8-50pf 350 WVDC N750 ceramic trimmer (inside of Z203-2)
C237-1 120pf 500 WVDC 2% mica (inside of Z203-1)
C237-2 120pf 500 WVDC 2% mica (inside of Z203-2)
C238-1 1500pf 300 WVDC 10% mica (inside of Z203-1)
C238-1 1500pf 300 WVDC 10% mica (inside of Z203-2)
C239-1 5-25pf 350 WVDC NPO ceramic trimmer (inside of Z204-1)
C239-2 5-25pf 350 WVDC NPO ceramic trimmer (inside of Z204-2)
C240-1 68pf 500 WVDC 2% mica (inside of Z204-1)
C240-2 68pf 500 WVDC 2% mica (inside of Z204-2)
C241-1 470pf 300 WVDC 2% mica (inside of Z204-1)
C241-2 470pf 300 WVDC 2% mica (inside of Z204-2)
C242-1 3-12pf 350 WVDC NPO ceramic trimmer (inside of Z205-1)
C242-2 3-12pf 350 WVDC NPO ceramic trimmer (inside of Z205-2)
C243-1 68pf 500 WVDC 2% mica (inside of Z205-1)
C243-2 68pf 500 WVDC 2% mica (inside of Z205-2)
C244-1 1800pf 500 WVDC 2% mica (inside of Z205-1)
C244-2 1800pf 500 WVDC 2% mica (inside of Z205-2)
C245-1 3-12pf 350 WVDC NPO ceramic trimmer (inside of Z206-1)
C245-2 3-12pf 350 WVDC NPO ceramic trimmer (inside of Z206-2)
C246-1 47pf 500 WVDC 2% mica (inside of Z206-1)
C246-2 47pf 500 WVDC 2% mica (inside of Z206-2)
C247-1 33pf 500 WVDC 2% mica (inside of Z206-1)
C247-2 33pf 500 WVDC 2% mica (inside of Z206-2)
C248 5000pf 1000 WVDC 15% ceramic
C249 .5pf 500 WVDC .25pf ceramic
C250 .75pf 500 WVDC .25pf ceramic
C251 1pf 500 WVDC .25% ceramic
C252 2pf 500 WVDC .25% ceramic
C253 4pf 500 WVDC .25pf ceramic
C254 8pf 500 WVDC .25pf ceramic
C255 33pf 500 WVDC 2% mica
C256 0.1mf 200 WVDC 10% paper (5)(z)
C257 47pf 500 WVDC 5% ceramic (z)
C273 5000pf 1000 WVDC 15% ceramic
C274 5000pf 1000 WVDC 15% ceramic
C275 0.033mf 300 WVDC 20% paper (z)
C276 15pf 500 WVDC 5% mica
C277 5000pf 1000 WVDC 15% ceramic
C278 15pf 500 WVDC 5% mica
C279 15pf 500 WVDC 5% mica
C280 5000pf 1000 WVDC 15% ceramic
C281 1.5pf 500 WVDC .25% ceramic
C282 1.5pf 500 WVDC .25% ceramic
C283-1 5-25pf 350 WVDC NPO ceramic trimmer (inside of Z213-1)
C283-2 5-25pf 350 WVDC NPO ceramic trimmer (inside of Z213-2)

C283-3 5-25pf 350 WVDC NPO ceramic trimmer (inside of Z213-3)
C284 5000pf 1000 WVDC 15% ceramic
C285 5000pf 1000 WVDC 15% ceramic
C286 100pf 500 WVDC 2% mica
C287 5000pf 1000 WVDC 15% ceramic
C288 5000pf 1000 WVDC 15% ceramic
C289 2pf 500 WVDC .25% ceramic
C290 2pf 500 WVDC .25% ceramic
C291-1 5-25pf 350 WVDC NPO ceramic trimmer (inside of Z216-1)
C291-2 5-25pf 350 WVDC NPO ceramic trimmer (inside of Z216-2)
C291-3 5-25pf 350 WVDC NPO ceramic trimmer (inside of Z216-3)
C292-1 100pf 500 WVDC 2% mica (inside of Z216-1)
C292-2 100pf 500 WVDC 2% mica (inside of Z216-2)
C292-3 100pf 500 WVDC 2% mica (inside of Z216-3)
C297 5000pf 1000 WVDC 15% ceramic
C298 5000pf 1000 WVDC 15% ceramic
C299 270pf 300 WVDC 2% mica (inside of T208)
C300 5000pf 1000 WVDC 15% ceramic
C301 5000pf 1000 WVDC 15% ceramic
C302 5000pf 1000 WVDC 15% ceramic
C303 5000pf 1000 WVDC 15% ceramic
C304 5000pf 1000 WVDC 15% ceramic
C305 5000pf 1000 WVDC 15% ceramic
C307 5000pf 1000 WVDC 15% ceramic
C308 5000pf 1000 WVDC 15% ceramic
C309 0.1mf 200 WVDC 10% paper
C310 3-60pf 850 WVAC ??? variable (calibration trimmer)
C311 1000pf 500 WVDC 2% mica
C312 150pf 500 WVDC 2% mica
C313 220pf 500 WVDC 2% mica
C314 220pf 500 WVDC 2% mica
C315 220pf 500 WVDC 2% mica
C316 15pf 500 WVDC 5% mica
C317 5000pf 1000 WVDC 15% ceramic
C318 51pf 500 WVDC 2% mica
C319 5000pf 1000 WVDC 15% ceramic
C320 1000pf 500 WVDC 2% mica
C321 12pf 500 WVDC 5% mica
C322 12pf 500 WVDC 5% mica
C323 5pf 300 WVDC .5pf mica
C324 20pf 300 WVDC 5% mica
C325 200pf 500 WVDC 1% mica
C326 5000pf 1000 WVDC 15% ceramic
C327 100pf 500 WVDC 2% mica
C328 5000pf 1000 WVDC 15% ceramic
C329 68pf 500 WVDC 2% mica

C330-1 300pf 500 WVDC 2% mica (inside of Z201-1)
C330-2 300pf 500 WVDC 2% mica (inside of Z201-2)
C331-1 68pf 500 WVDC 2% mica (inside of Z202-1)
C331-2 68pf 500 WVDC 2% mica (inside of Z202-2)
C334 51pf 500 WVDC 2% mica

(z) actual value depends on mod level, I'll add details when I have time
(4) This is the stud mounted oil filled capacitor located on the top side of the chassis next to V201, the 6DC6.
(5) Not used on early receivers. C256 is used to silence hash/static from HR202 Crystal Oven. Less expensive CDE polyester should work fine at this location.

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- -----Crystal Oscillator Subchassis-----
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C401 5000pf 1000 WVDC 15% ceramic
C402 5pf 300 WVDC .5pf mica
C403 4pf 500 WVDC .25pf ceramic
C404 4pf 500 WVDC .25pf ceramic
C406 5000pf 1000 WVDC 15% ceramic
C407 5000pf 1000 WVDC 15% ceramic
C408 12pf 500 WVDC 5% ceramic
C409 150pf 500 WVDC 2% mica
C410 5000pf 1000 WVDC 15% ceramic
C411 5000pf 1000 WVDC 15% ceramic
C412 5000pf 1000 WVDC 15% ceramic
C413 5000pf 1000 WVDC 15% ceramic
C414 5000pf 1000 WVDC 15% ceramic
C415 5000pf 1000 WVDC 15% ceramic
C417 150pf 500 WVDC 2% mica
C418 120pf 500 WVDC 2% mica
C419 100pf 500 WVDC 2% mica
C420 82pf 500 WVDC 2% mica
C421 68pf 500 WVDC 2% mica
C422 56pf 500 WVDC 2% mica
C423 47pf 500 WVDC 2% mica
C424 39pf 500 WVDC 2% mica
C425 33pf 500 WVDC 2% mica
C426 18pf 500 WVDC 5% mica
C427 12pf 500 WVDC 5% mica
C428 5pf 300 WVDC .5pf mica
C429A 8-50pf 350 WVDC NPO ceramic trimmer for 9 MHz
C429B 8-50pf 350 WVDC NPO ceramic trimmer for 8 MHz
C429C 5-25pf 350 WVDC NPO ceramic trimmer for 15 MHz

C429D 5-25pf 350 WVDC NPO ceramic trimmer for 14 MHz
C429E 5-25pf 350 WVDC NPO ceramic trimmer for 4&21 MHz
C429F 5-25pf 350 WVDC NPO ceramic trimmer for 3&20 MHz
C429G 5-25pf 350 WVDC NPO ceramic trimmer for 27 MHz
C429H 5-25pf 350 WVDC NPO ceramic trimmer for 26 MHz
C430A 8-50pf 350 WVDC NPO ceramic trimmer for 11 MHz
C430B 8-50pf 350 WVDC NPO ceramic trimmer for 10 MHz
C430C 5-25pf 350 WVDC NPO ceramic trimmer for 0&17 MHz
C430D 5-25pf 350 WVDC NPO ceramic trimmer for 16 MHz
C430E 5-25pf 350 WVDC NPO ceramic trimmer for 6&23 MHz
C430F 5-25pf 350 WVDC NPO ceramic trimmer for 5&22 MHz
C430G 3-12pf 350 WVDC NPO ceramic trimmer for 29 MHz
C430H 5-25pf 350 WVDC NPO ceramic trimmer for 28 MHz
C431A 5-25pf 350 WVDC NPO ceramic trimmer for 13 MHz
C431B 5-25pf 350 WVDC NPO ceramic trimmer for 12 MHz
C431C 5-25pf 350 WVDC NPO ceramic trimmer for 2&19 MHz
C431D 5-25pf 350 WVDC NPO ceramic trimmer for 1&18 MHz
C431E 5-25pf 350 WVDC NPO ceramic trimmer for 25 MHz
C431F 5-25pf 350 WVDC NPO ceramic trimmer for 7&24 MHz
C431G 3-12pf 350 WVDC NPO ceramic trimmer for 31 MHz
C431H 3-12pf 350 WVDC NPO ceramic trimmer for 30 MHz

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- -----IF Amplifier Subchassis-----
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C501 5000pf 1000 WVDC 15% ceramic
C502 5000pf 1000 WVDC 15% ceramic
C503 100pf 500 WVDC 2% mica
C504 0.1mf 200 WVDC 10% paper
C505 0.1mf 200 WVDC 10% paper
C506 5000pf 1000 WVDC 15% ceramic
C507 110pf 500 WVDC 2% mica for 16 KHz filter (x)
C508 110pf 500 WVDC 2% mica for 8 KHz filter (x)
C509 110pf 500 WVDC 2% mica for 4 KHz filter (x)
C510 110pf 500 WVDC 2% mica for 2 KHz filter (x)
C511 5000pf 1000 WVDC 15% ceramic
C512 5000pf 1000 WVDC 15% ceramic
C513 110pf 500 WVDC 2% mica for 2 KHz filter (x)
C514 110pf 500 WVDC 2% mica for 4 KHz filter (x)
C515 110pf 500 WVDC 2% mica for 8 KHz filter (x)
C516 110pf 500 WVDC 2% mica for 16 KHz filter (x)
C517 0.1mf 200 WVDC 10% paper
C518 5000pf 1000 WVDC 15% ceramic
C519 5000pf 1000 WVDC 15% ceramic
C520 3-12pf 350 WVDC NPO ceramic trimmer (inside of Z501)

C521 0.1mf 200 WVDC 10% paper
C522 5000pf 1000 WVDC 15% ceramic
C523 5000pf 1000 WVDC 15% ceramic
C524 75pf ??? WVDC ??% ceramic (inside of Z501)
C525 7-10.5pf 350 WVDC NPO ceramic trimmer (BFO neutralization)
C526 100pf 500 WVDC 2% mica
C527 5pf 300 WVDC .5pf mica
C528 0.1mf 200 WVDC 10% paper
C529 0.033mf 300 WVDC 20% paper
C530 150pf 500 WVDC 2% mica
C531 0.1mf 200 WVDC 10% paper
C532 100pf 500 WVDC 2% mica
C533 0.033mf 300 WVDC 20% paper
C534 0.033mf 300 WVDC 20% paper
C535 12pf 500 WVDC 5% mica
C536 0.1mf 100 WVDC 20% paper
C537 1800pf 500 WVDC 2% mica
C538 0.1mf 200 WVDC 10% paper
C539 1000pf 500 WVDC 2% mica
C540 5000pf 1000 WVDC 15% ceramic
C541 0.033mf 300 WVDC 20% paper
C542 47pf 500 WVDC 2% mica
C543 0.1mf 200 WVDC 10% paper
C544 5000pf 1000 WVDC 15% ceramic
C545 0.033mf 300 WVDC 20% paper
C546 220pf 500 WVDC 2% mica
C547 0.1mf 200 WVDC 10% paper
C548 0.1mf 200 WVDC 10% paper
C549 0.01mf 300 WVDC 20% paper
C551 2.0mf 500 WVDC 10% oil filled paper (2)
C552 5000pf 1000 WVDC 15% ceramic
C553 0.01mf 300 WVDC 20% paper (3)
C554 1600pf 100 WVDC 1% mica (inside of Z502 - BFO)
C555 50pf ??? WV?C ??% ??? (inside of Z502 - BFO)
C556 50pf ??? WV?C ??% ??? (inside of Z502 - BFO)
C557 ???? ??? WV?C ??% ??? (inside of T501)
C558 ???? ??? WV?C ??% ??? (inside of T501)
C559 ???? ??? WV?C ??% ??? (inside of T502)
C560 ???? ??? WV?C ??% ??? (inside of T502)
C561 ???? ??? WV?C ??% ??? (inside of T503)
C562 ???? ??? WV?C ??% ??? (inside of T503)
C563 ???? ??? WV?C ??% ??? (inside of Z501)
C564 8-50pf 350 WVDC N750 ceramic trimmer for 16 KHz filter (x)
C565 8-50pf 350 WVDC N750 ceramic trimmer for 8 KHz filter (x)
C566 8-50pf 350 WVDC N750 ceramic trimmer for 4 KHz filter (x)
C567 8-50pf 350 WVDC N750 ceramic trimmer for 2 KHz filter (x)

C568 8-50pf 350 WVDC N750 ceramic trimmer for 2 KHz filter (x)
C569 8-50pf 350 WVDC N750 ceramic trimmer for 4 KHz filter (x)
C570 8-50pf 350 WVDC N750 ceramic trimmer for 8 KHz filter (x)
C571 8-50pf 350 WVDC N750 ceramic trimmer for 16 KHz filter (x)

(x) value depends on mod level of IF deck. I'll add details later...
(2) Oil filled metal can paper capacitor mounted to top side of chassis next to chassis harness connector.
(3) Blocking cap for mechanical filters. Recommend working voltage of 600VDC or higher to help decrease the chance of frying the mechanical filters due to failure of C553. This is not a good location to use a cheap replacement capacitor.

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- -----Audio Frequency Amplifier Subchassis-----
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C601 0.01   300 WVDC 20% paper
C602 0.033 300 WVDC 20% paper
C603 3X30uf 300 WVDC ??% Electrolytic (Industry # CE53C300N)
C604 0.01   300 WVDC 20% paper (6)
C605 0.01   300 WVDC 20% paper (6)
C606 2X45uf 300 WVDC ??% Electrolytic (Industry # CE52C450N)
C607 0.01   300 WVDC 20% paper
C608 0.01   300 WVDC 20% paper
C608 0.01mf 300 WVDC 20% paper
C609 8uf   30 WVDC ??% Tantalum Electrolytic (7)
C611 5000pf 1000 WVDC 15% ceramic
C612 68pf   500 WVDC 2% mica

(6) For improved audio performance, you can use .022uf caps at this location.

(7) Also known as "the capacitor that rots off". Leaks sulfuric acid when the seals fail. Watch the polarity when replacing.

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- -----PTO (VFO) Subchassis-----
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C701 370pf 500 WVDC 1% ???? (inside of PTO)
C702 10pf ??? WV?C ??% ???? (inside of PTO)
C703 10pf ??? WV?C ??% ???? (inside of PTO)
C704 15pf 500 WVDC 2% ???? (inside of PTO
C705 5000pf 1000 WVDC 10% ceramic (y)
C706 1.5-8pf ??? WV?C ??% glass/silver piston trimmer (inside of

Z702)
C707 5000pf 1000 WVDC 10% ceramic (y)
C708 5000pf 1000 WVDC 10% ceramic (y)
C709 510pf   300 WVDC 2% mica (inside of Z702)
C710 5000pf 1000 WVDC 15% ceramic
C711 5000pf 1000 WVDC 15% ceramic
C712 5000pf 1000 WVDC 10% ceramic (y)
C713 5000pf 1000 WVDC 10% ceramic (y)
C714 5000pf 1000 WVDC 10% ceramic (y)

(y) C705, C707, C708, C712, C713, and C714 are all constructed into one unit. Some are epoxied together, some are in plastic holders, etc.

Date: Fri, 11 Dec 1998 05:29:06 -0000
From: Chuck Rippel <wa4hhg@amsat.org
Subject: Re: caps

Use polypropylene media Orange Drop capacitors for circuits operating at 455kc and below. If you want to be really fancy, bypass those with a .001 ceramic disk. I get my Orange Drops from Antique Radio:
http://wwwtubesandmore.com

Use 1KV Ceramic discs for frequencies above 455KC
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From: wli@u.washington.edu
Date: Wed 8 Oct 1997

I had a chance to go over Nolan's R-390A cap list, and rehacked it to reflect my needs. This is only a working list, so let me know of errors. A shopping list for any recap kit would include:
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(13) 0.1 ufd
C256, C309, C504, C505, C517, C521, C528, C531, C536, C538, C543, C547, C548,

(7) 0.033 ufd
C275, C529, C533, C534, C541, C545, C602

(7) 0.01 ufd
C549, C553, C601, C604, C605, C607, C608

(I'd go with the SBE 716P 600v OD's at the outset, seeing as how recapping is not a trivial project)

(3) 30 ufd 300 v electrolytic C603
(2) 47 ufd 300 v electrolytic C606

(Sticking new electrolytics in an empty octal relay case as Tom Norris did, worked out swell for me)

Finally, only one needed of:

0.047 ufd 100v C227
8 ufd 30v tantalum electrolytic C609
50 ufd 50 v electrolytic C103
2 ufd 500v C551 oil-filled paper
0.22 ufd 100v C101

Obviously C553 and C549, and the AF deck electrolytics C603 and C606 take precedence in any recap project, as stressed in earlier posts. Now here is a chance for AES to make up a 37 item kit (just kidding).....

Thanks, W. Li
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Date: Fri, 10 Oct 1997 23:18:02 -0700
From: jim thompson <jim@...>
Subject: [R-390] Re: Replacing old capacitors...

This is an excellent topic. I have enjoyed everyone's comments. It is timely, too, at least for me, as I am going through all my S-Line gear and giving each unit a thorough cosmetic and electrical restoration. Tonight, I just finished recapping a 75S-3C and one thing hit me.

I suppose it's the old "you can't see the forest for the tree" bit, but a couple of weeks ago, I began work on a 75S-3 and didn't have all the correct parts to replace every paper and other junk cap along with the electrolytics. So, in went an order for the parts and because I knew I had several KWM-2's and S-Line's to rework, I ordered several sets of parts. The parts arrived today, and I set about replacing the caps in the 75S-3C. To my surprise, what I hadn't noticed before is that Collins had switched almost exclusively to ceramics. The bag full of Mylar caps that just arrived was useless. That has to say something about which type of capacitor to use when restoring a older receiver.

Now, back to the parallel capacitor discussion. I just pulled my copy of the schematic for a RACAL 6117A receiver. If you're not familiar with this receiver, it was made back in the 60's and used some rather fancy circuitry for changing bands. There is a lot of unusual circuitry in this receiver and it starts with the RF amplifier. The RF amplifier is a 6ES8. I believe that this is only remote-cutoff dual triode ever produced. It has a very low noise figure and its effective noise resistance is under 200 as I recall. This is a wideband amplifier covering 1 - 30 MHz. I say all this to

set the stage for the bypassing scheme used by the engineers at RACAL. The RF amp is a modified cascaded design with the plate of the input stage directly feeding the cathode of the second triode. This means that the grid of the second triode is bias at 1_2 the B+ voltage. Now for the bypassing.

On the cathode of the first triode is a 0.1 uf and a 0.001 uf cap. The filament is also bypassed with the same combination of caps plus several ferrite beads are used in series with the filament lead. The grid of the second tube (essentially a grounded grid stage at RF) is bypassed with a .05 and a .001 cap in parallel. In the B+ in series with an L/C in the plate lead of the second triode are two resistors in series with a parallel .05 and a .001 cap from the center-tap of the two resistors to ground. I notice that the second mixer also uses a .1 uf and a .001 uf cap in parallel on the cathode, while the first mixer uses only a single .001. That might be because the fist mixer is followed by a 40 MHz filter and they want all the degeneration they can get at lower frequencies.

Checking with the parts list, the .1 caps are paper and the .001 caps are ceramic. Going through the schematic, it seems that anytime they use a paper cap at RF, they put a .001 ceramic in parallel.

That leaves a couple of questions to be answered. Is there a real advantage in putting a 1000 pf ceramic across the .1 uf (Orange Drops or otherwise) as we rework the rigs? After all, they seem to work well as they are. Or, so we go in the direction that Collins did and just replace all the paper caps with ceramics (including some rather large .1 uf parts)? I know that some Mylar caps are specified as being "non-inductive," then so is a good ceramic. Anyway, does the collective wisdom of the group have any further thoughts on the subject. I think I may redo one of my 75S-3's with ceramics since the S-3C went in that direction. However, would you go with .1 ceramics in a 75A-4? I know that it would trash the under chassis cosmetics, but then yellow Mylars or Orange Drops don't look all that original either. Which way would you go? Having fun making old radios better, or at least getting them back to the way they were.

Date: Sun, 12 Oct 1997 10:03:40 +0500
From: "Chuck Rippel" <crippel@...>
Subject: [R-390] Replacing Capacitors

I have really enjoyed this discussion. The capacitor isssue is close to me because I firmly believe that the higher voltage types, as replacment components, will disappear long before tubes will. Yes, like most of us I keep a stock of tubes at hand but I also have a store of caps around.

My current project is restoring a Hammarlund SP-600JX. Most of these radios are full of "black beauties" which although check ok as far as

capacitance is concerned, leak horribly causing the power supply chokes to fail. So, all those most come out. In the past, I have replaced all with Orangedrops but am considering putting ceramic discs in the RF section and Orangedrops from the IF, forward.

It also looks like I am too much of a theorist when it came to piggybacking say 0.1's with 0.001's. Never saw it done before and the idea seemed too easy a solution for an electrically more convoluted problem. I will try doing this in a few places in this SP-600.

Date: Sun, 12 Oct 1997 11:50:00 -0400 (EDT)
From: Michael Crestohl <mc@...>
Subject: [R-390] Forwarded message from Chuck Rippel WA4HHG

I got you nice note and forwarded it to work then ran out of time to give you a good answer. In brief, I agree with you in principal but am skeptical of the real life effectiveness of biggybacking a .001 across a .01 and getting the results you cite.

Everything you say is true under very controlled conditions. The .01 would shunt certain frequencies as would the .001. What you would really have is a .011 capacitor. Again, this would only happen in a purely resistive circuit. In as much as noise is an A/C component, reactance rears its ugly head and all of our assumptions based on the circuit being purely resistive go out the window.

I would have to do some digging back in my text books to quote the exact theory and math to support it but in a nutshell, (more trouble that its worth) my position would be that you while you could do that, the desired effect would not be as predictable as you state. There are a lot of reactive variables induced by both the load and source portions of the circuit which would have profound effects on the frequency response of the capacitors.

Again, I would have to go to a textbook which I am sure is in my attic but if you were to make a "T" network out of the capacitors with the "top" of the "T" being say.... a 1k resistor, that might decouple the two capacitors sufficiently for them to act independently in a much more predictable manner due to the de-coupling effect of the resistor.

Once again, the facts you cite are 100% accurate, my only point is that in real life, I'd be tough to get the results we want unless the other circuit parameters were accomodated in some way.

Darn good point of discussion though!

Glad you are doing an SP-600. How many hours you tink it will take to re-cap, turrett and all? The first one I did, a JX1, took about 14 days.

Date: Sat, 11 Oct 1997 00:00:40 -0400
From: Ed Tanton <n4xy@...>
Subject: Re: Replacing old capacitors...

Hi Chuck... the theory was there-and then some-when this was presented in Electronics Design sometime in the late 70s... they used 3 caps however. The statement was simply that the three caps were VERY much more effective than any ONE would have been, and that they represented multiple values according to what "stuff" went at them, so to speak. The bottom line was not merely effective, but much more effective... and I think the math and the graphs were shown. You wouldn't do it everywhere... I suspect there is a diminishing return on value vs cost at most nodes, but use it when you want the most efficacy, cost-be-damned. I once ran some ESR tests to try and determine the most effective single CK05 bypass: 0.001/0.01/0.1 for our MIL CMOS/TTL/LSTTL/etc. circuits, and the bottom line-surprisingly-was the 0.1 had the lowest overall ESR over the range of frequencies we were concerned with as trouble (the RF stuff was generally microwave) but the potential self osc. and other problems that might make their presenses known from certain sweeping and blocking oscillators were LF-HF and the good old monolythic 0.1uFd CK05BX104JAN was easily the winner. Mostly based on its higher freq performance being OK and the LF performance of the 0.01 & 0.001s not being nearly as good in overall perspective. Actually, around most regulators and other DC places I REALLY want good QRN suppression, I usually use 4 caps: .001-1.0-with the 1.0 a tantalum... AND a molded ferrite-on-a-wire then in series with the line. Never seen it fail!

Date: Sun, 24 May 1998 09:38:43 -0500
From: "Dr. Gerald N. Johnson, P.E." <geraldj@ames.net>
Subject: [Fwd: Re: [R-390] Orange Drop Questions]

My experiences have been with the 225P **polyester (mylar)** caps. They are flatter than the round 715P according to the photos. 400 volts should handle everything in the R390.Disc ceramics should already be in the RF sections, I'd think though I've not dug in there.

Mouser does carry carbon composition resistors. Their part number 30BJ500-. These ought to be closest to the original RF resistors. Metal film resistors though they may fail differently should be appropriated for bypass damaged screen and plate voltage (and cathode) resistors in all stages. 73, Jerry, K0CQ

Date: Sun, 24 May 1998 16:35:56 -0400

From: Ed Tanton <n4xy@att.net>
Subject: Re: [R-390] Orange Drop Questions

Hi Nolan... I think you answered-in part-your question about Orange Drops... if there is room, use at least a 20% higher voltage cap than the original-and I'd stick to 600V or more unless there is no way to get it in the same spot. Of course, it is not necessary to replace a 50 or 100V cap w/600V but sticking to 600V makes it easier for you to plan ahead and buy a batch of common values @ 600VDC. There are several surplus dealers who have certain useful values at MUCH better prices.

As for the resistors, I don't think I'd change anything that was w/in 10% and maybe even 20%... but somewhere around there, I'd start changing them-well... honestly, if I was already in there, and all, I'd probably change at >10%. Also, if ANY resistor looks like it ran hot, it'd have to go, and a step higher wattage would be put in its place. Finally, all 'black beauties' must be removed and buried in a corner of your back yard the night of the next full moon (so they never return in any other rigs.)

Date: Mon, 25 May 1998 18:06:41 -0500
From: Nolan Lee <nlee@communique.net>
Subject: [R-390] restoration parts 'n stuff...

I gunked the RF deck from my old Collins again and dried it in the sun, yes on the clothes line, next to my possum fur collared goin' out to impress gals shirt, for a couple of days and started inspectin' and testin' components. I've had real good luck using Gunk. It seems to be good on tractors, dogs, diesel engines, AND radios. :-)

Most of the resistors are ok, some have increased in value to about 10% over their marked values, these I intend to replace. Notice I said most? Every 2200 ohm 1/2watt resistor in the the Collins RF Deck has increased in value to a minimum of 4K. None show signs of over-heating and none of the 2200 ohm resistors in any of the other modules or the EAC deck have increased like this. I suspect a bad lot. Weird, huh? You bet, Twilight Zone dude...

At any rate, There are three of them there "giant resistor looking" tubular caps under the RF deck. Only one is shown in the manual so I suspect that the other two were part of a MWO. (I need to find my missing list of MWO's for the R390A) One is attached to the 6.3V pin of the crystal oven probably to kill rf from the oven switching on and off.

The values on these are 0.1 and 0.033. I've added them to the parts order list. I've got a decent amount of room so I'll replace them with 600V rated 715P Sprague's. It appears that more of you guys like the 715P series over

the 225P series....

What else should I suspect in the RF Deck? While I have this thing out, there's got to be something else that's prone to failure that I should check or order a replacement for. I'd really like to do the RF deck once. I'm ordering a handful of silver micas of the values used in the RF deck in the event it turns out that some of the rectangular molded micas there are bad. I intend to replace any of them that either have to be removed or have one leg unsoldered to access any of the resistors or paper caps that I have to replace. Ditto for the ceramic disc caps. What have I missed?

On the IF decks, I've listed all (16) paper/tubular caps in each deck (I'm doing 4 of the 7 decks) for replacement and between a dozen to 2 dozen resistors per deck. Again, I intend to replace any molded mica or ceramic disc that has to be unsoldered for access. What have I missed here?

The audio decks have been hashed out via email with a few of you guys so I feel OK with them. I'm still waiting on an answer on the value of C609. I suspect that both of the manuals are wrong. There's no way that an 8uf 300VDC cap is that size. What's the actual value of this goofy looking sucker?

What about the Crystal Osc. deck? A couple of the carbon resistors in two of the decks are out of spec so they'll be replaced. Any thing I missed on these modules?

I haven't opened up the shielding under the the bottom of the little chassis attached to the VFO modules yet. I'll do them later tonight. Any common failures here?

Oh, almost forgot. I haven't checked the little board mounted to the front panels just above the counters. Anything prone to failure here? And, last but not least, I'm low on 327 and 328 bulbs and might as well order some with this parts order. What the numbers for the long life variant of each? How does the intensity compare? Thanks in advance and have a safe holiday bubba!

Date: Tue, 29 Sep 1998 14:27:46 -0400
From: "Chuck Rippel" <crippel@exis.net>
Subject: RE: [R-390] Upgraded Caps

> Hi Chuck:>Is there any reason why equivalent disc ceramics won't work? >Just a question since RS is just down the street. Cal.

I don't use disc ceramics at that frequency as the **polypropylene** media Orange Drops transfer energy so much better at that (455kc) frequency.

Now, at 455kc and ABOVE, the ceramic disks or Silver Mica's are fine and even preferred. Also, the Orangedrops approximately replicate the characteristics and design intent of the original Sprague "Vitamin Q" that is replaced. Capacitor application discussions have always been interesting. Some types work better than others depending on frequency and application.

Date: Tue, 19 May 1998 18:32:36 -0500
From: "Dr. Gerald N. Johnson, P.E." <geraldj@ames.net>
Subject: Re: [R-390] Flight of the Phoenix Msg 1

I like Sprague Orange Drop capacitors. They don't get leaky as far as I can tell from 40 years experience. You probably need to replace ALL the molded paper capacitors. Last time I went through a whole receiver, I did find one molded mica that was leaky so they can go bad. Probably from poor manufacturing. I found NO molded paper capacitors that weren't leaky. <SNIP>

Date: Sun, 24 May 1998 09:38:43 -0500
From: "Dr. Gerald N. Johnson, P.E." <geraldj@ames.net>
Subject: [Fwd: Re: [R-390] Orange Drop Questions]

My experiences have been with the 225P polyester (mylar) caps. They are flatter than the round 715P according to the photos. 400 volts should handle everything in the R390. Disc ceramics should already be in the RF sections, I'd think though I've not dug in there. Mouser does carry carbon composition resistors. Their part number 30BJ500-. These ought to be closest to the original RF resistors. Metal film resistors though they may fail differently should be appropriated for bypass damaged screen and plate voltage (and cathode) resistors in all stages. 73, Jerry, KOCQ

Date: Sun, 24 May 1998 16:35:56 -0400
From: Ed Tanton <n4xy@att.net>
Subject: Re: [R-390] Orange Drop Questions

Hi Nolan... I think you answered-in part-your question about Orange Drops... if there is room, use at least a 20% higher voltage cap than the original-and I'd stick to 600V or more unless there is no way to get it in the same spot. Of course, it is not necessary to replace a 50 or 100V cap w/600V but sticking to 600V makes it easier for you to plan ahead and buy a batch of common values @ 600VDC. There are several surplus dealers who have certain useful values at MUCH better prices. As for the resistors, I don't think I'd change anything that was w/in 10% and maybe even 20%... but somewhere around there, I'd start changing them-well... honestly, if I was already in there, and all, I'd probably change at >10%. Also, if ANY resistor looks like it ran hot, it'd have to go, and a step higher

wattage would be put in its place.

Finally, all 'black beauties' must be removed and buried in a corner of your back yard the night of the next full moon (so they never return in any other rigs.)

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The Seven Deadly Caps in 75A-4's

The 75A-4's can be plagued with problems associated with low gain and audio popping or distortion. The source of these problems have been pin pointed to those interstage coupling capacitors which couple the plate of one stage to the grid of another.
In my trials to finish off the A-4 on which I have been toiling, I did a little research on the classic cap problem and identified the trouble areas. They are:

C-34 100pf V-3 Pin 3
C-52 4pf V-5 Pin 7
C-68 470pf V-7 Pin 2
C-75 470pf V-8 Pin 1
C-81 470pf V-9 Pin 1
C-101 .01uf V-22 Pin 1
C-104 470pf V-21 Pin 1

I later spoke with Butch, K0BS who added the following 3 capacitors:

C-71 1000pf V-7 Pin 6 C-71 is a know high failure item
C-95 .01uf V-11 Pin 6
C-96 .01uf V-12 Pin 2

The capacitors in the picofarad range should be replaced with dipped mica's with 500 volt ratings. The 0.01uf capacitors are best replaced with 600V Sprague Orangedrops

I also replace all the "black beauty" 0.1mfd capacitors in the A-4 with 0.1 mfd, 400V Sprague Orange Drops. I believe there are 13 or 14 of them....

Date: Tue, 29 Sep 1998 13:01:12 -0600
From: "Eustaquio, Cal J" <cal.j.eustaquio@lmco.com>
Subject: RE: [R-390] Upgraded Caps

Wow! I am surprised at that. Guess I'll have to fish out those disc caps I have in there and replace it with the Orange Drop equiv. Tnx. Cal. P.S. I'm sending this on the reflector since there are others who may have been thinking about doing the same.

Date: Tue, 06 Oct 1998 02:31:38 -0500
From: Nolan Lee <nlee@gs.verio.net>
Subject: [R-390] R390A paper capacitors

I just removed all three of the paper/tubular capacitors from the RF deck of the EAC. This is a very low mileage "cherry" deck with the original tubes. Using a loupe, I noticed that the "brown beauty of death" had a microscopic split about a half an inch long down one side just like most of the ones I'd looked at. I threw it on the RC bridge and couldn't get a solid value. It did slightly "dip" at about 0.033mf. I tried a leakage test. Almost a dead short above about 50 volts or so. I haven't found one of these style capacitors yet that was good. Maybe it's the humidity here or just bad juju.

I tried the two yellow 0.1mf 200V Aerovox capacitors from under the crystal oven. Only a slight "dip" of an indication of the value on either of them. One leaked like hell at voltages about 30 volts and the other broke down totally at about 100 volts or so. Granted, one of them is only used help kill the static from the 6.3V oven cycling on and off and would have probably continued to work for decades to come, it was bad. I've been testing all of the caps that I've been replacing. Maybe 10 to 20 percent of the hermetically sealed Vitamin Q style ones won't meet spec. None of the "brown beauties of death" will even come close and about a third to half of the yellow Aerovox ones are bad.

A lot of people questioned my replacing of all of the capacitors. I'll stand by my decision. **These tests have reinforced my opinion that if you remove a module from an R390A, to work on it, replace all of the original paper caps in it before putting it pack in the radio**. If you don't want to replace them all, at least make sure that you **replace the brown tubular ones.** Only a couple of three dollars and you've eliminated a possible cause of flat out failure that could cause damage to something expensive and a pain in the ass to change or at the least, decreased performance.

Date: Tue, 6 Oct 1998 11:16:25 -0400 (EDT)
From: aa024@detroit.freenet.org (Kenneth Vito Zichi)
Subject: [R-390] MOD 1 IF Deck ... or is it?

Pulled the IF deck out to replace the C553 and got quite a surprise. The deck is STAMPED MOD1, but it appears to be an 'unmodified' version per the photos in the TM. I pulled the cover off the mechanical filters and lo and behold, instead of variable trimmer caps, there are the fixed ones too. (side question-what the heck are these style of fixed caps called-you know the red or beige little rectangles with 3 or 6 color dots on 'em to indicate the value and tolerance.... mica? ceramic? etc) Was this Collins putting

one over on Uncle or am I missing something?

Date: Tue, 06 Oct 1998 09:45:17 -0600
From: "Eustaquio, Cal J" <cal.j.eustaquio@lmco.com>
Subject: [R-390] R390A paper capacitors and heat damage

Been following the your post regarding paper caps and I've come to basically your conclusion. I found that usually the elevated temps are probably to prime cause of cap death. I'm wondering if any studies have been done on this subject. Thinking about it, there is a lot of heat in the R-390 that is not vented off. Trapped in these aluminum boxes, I would guess they have a tendency to trap heat emitted by the various tubes from within, changing the dielectric characteristics and packaging of those caps. Now looks like I'll have to pull apart my "Frankenstien" R-390A and check those components that you mentioned. Cal.

Date: Tue, 06 Oct 1998 12:15:08 -0500
From: "Dr. Gerald N. Johnson, P.E." <geraldj@ames.net>
Subject: Re: FW: [R-390] R390A paper capacitors and heat damage

Sometimes high temperature will accelerate capacitor failures, but my point was that even without operating most of the paper capacitors in that NC-300 (circa 1955) failed by 1975. Their failure didn't need any help of heat or applied voltage.

Date: Tue, 06 Oct 1998 13:11:57 -0600
From: "Eustaquio, Cal J" <cal.j.eustaquio@lmco.com>
Subject: RE: FW: [R-390] R390A paper capacitors and heat damage

Then seems like both could be party to failure whether in hard usage or long term storage. Cal

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Date: Mon, 28 Dec 1998 10:26:33 -0600
From: "Dr. Gerald N. Johnson, P.E." <geraldj@ames.net>

T**he choices on Orange Drops are polyester,** not polystyrene, and polypropylene. My long term experiences have been with the polyester. I have a little less confidence in the polypropylene,----------

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Date: Tue, 06 Oct 1998 19:12:47 -0500
From: Nolan Lee <nlee@gs.verio.net>
Subject: Re: [R-390] R390A paper capacitors

I've been checking the values of the resistors too. In the old Collins R390A, many are out of tolerance, in the EAC, very few are. It's possible that the 12 year or so difference in age may have something to do with it.

;-(

>I totally agree with replacing all the paper and electrolytic capacitors at the same time. I've >not found enough good ones in radios of the 50s and 60s vintage to trust any.

Granted, the RF decks are a pain to remove, but there are only three capacitors on it that would be considered "suspect" and all are easy to get to. The IF deck is a lot easier to remove but a pain because of the tight construction and the number of capacitors, especially the "brown beauties of death".

>So far, I've not found a significant number of micas and disc ceramics >leaking, but that's not to say that they have ALL been perfect. They can >fail too, but just don't seem to fail as universally as the oiled paper capacitors.

Agreed. On a side note, those yellow Aerovox capacitors that were used in some of the R390A's will be destroyed in a heartbeat if the sides of them are accidentally touched with a soldering iron. It'll melt right thru the insulation and a few layers of foil so fast it'll scare you.

Date: Tue, 06 Oct 1998 20:06:04 -0500
From: Nolan Lee <nlee@gs.verio.net>
Subject: Re: [R-390] R390A paper capacitors and heat damage

At 10:19 AM 10/6/98 -0500, you wrote:>I doubt heat has a lot of effect. Might even slow the aging of the capacitors by keeping moisture out.

I suspect that you're right. Age is the problem. I had a batch of NOS military tubulars a number of years back that were all leaky. They're never been used and I doubt that they'd ever been subjected to adverse environmental conditions. A large percentage of the brown tubulars in my R390A's have microscopic cracks in the body. It might be fatigue from temp changes. I don't know.

>Check them if you must but replace them anyway, is how I look at it.

I'm replacing all of them, I still find the testing interesting. :-) There's no way in hell that I'd go thru the trouble to remove one and not replace it even if it did test OK, not for the 50 cents or so that it costs to replace.

Date: Tue, 06 Oct 1998 20:47:19 -0500
From: Nolan Lee <nlee@gs.verio.net>
Subject: Re: [R-390] R390A paper capacitors and heat damage

I don't know if it's elevated temps or not. I was just sitting here thinking. Figuring that those capacitors are 30 to 40+ years old. How many times have they went thru a temp swing of say 40 degrees, from 70 degree room temp to say 110 degrees for a few hours of listening then back down to 70 after the receiver is shut off. Let's throw in a few drops to zero degrees while in storage somewhere or maybe just a few drops to 40 degrees.

I could just be normal expansion and contraction forming those little microscopic cracks that allow moisture in. I'm no engineer, just a redneck, so my theory may be flawed, bubba.

>I'm wondering if any studies have been done on this subject.

I'd imagine that someone at Sprague would know. Might be worth dropping a letter.

>Thinking about it, there is a lot of heat in the R-390 that is not vented off.

I never did consider the R390A a "hot" receiver. There are a few areas of localized heat that might be considered high like the pair of 26Z5W's or the audio deck with the power resistors under the chassis, but as a whole it isn't as bad as some other BA stuff I've owned. I think that total power consumption with the ovens off is only about 150 watts or so. For the size and mass of it, that doesn't seem like too much. I suppose that additional cooling of the audio module could be done with something as simple as a #6 or #8 flat washer between each of the mounting screws of the audio module and the main frame of the R390A. this might allow the heat from under the chassis of the inverted audio module to escape easier. I'd guess that the same thing could be done to the IF module.

>Trapped in these aluminum boxes, I would guess they have a
>tendency to trap heat emitted by the various tubes from within, changing the dielectric >characteristics and packaging of those caps. Now looks like I'll have to pull apart my >"Frankenstien" R-390A and check those components that you mentioned. Cal.

I'd change any and all of the "brown beauties of death". After you remove them, test them before you trash them. I'd be interested in your findings. If you don't have the gear to test them, toss them in an envelope and I'll test them. I run a lot of the stuff that I have around here on Variacs. I'd imagine that running the R390A at 115 volts rather than 120 to 125 volt line voltage that some people have would help lower the temp too.

Date: Wed, 07 Oct 1998 00:00:41 -0500
From: Nolan Lee <nlee@gs.verio.net>

Subject: Re: [R-390] Evil Capacitors

They're a lousy cap, I've got a package of NOS ones around here some where. All are leaky. They were also made in black with those colored bands. Had a few of them in my 1960 vintage HP HV PS that were shorted. All of the paper caps in it leaked. I'm on a paper cap replacement binge right now. I guess that I've ordered well over a hundred dollars worth of them over the last few months. My next cap replacement project will be my HP VTVM's and my Tek scope.

>Now I'm wondering what this cap did and why it has not caused a problem, also are the >Westcaps on the list of "Ten Mostly Deadly" capacitors. There's a bunch of them in my '67 >EAC.

They don't seem to be any worse than any of the other brands of glass seal hermetically sealed metal cased paper caps. Off the top of my head, I think that Good-All and one other brand was used in the R390A's. I've only found maybe one in ten of the metal cased ones that are leaky when getting close to maybe 3/4ths of their rated voltage. They held up a hell of a lot better than the other style paper caps that were used in the R390A. I'd imagine that they cost a lot more too. ;-(There was another capacitor that Chuck said that he's seen leaky in some radios that caused low audio output if I remember right. I'm pretty sure that it was one of the metal bodied ones. I don't remember which one it was but from what I gathered, it didn't take a hell of a lot of leakage to seriously affect the audio output. What was the story on this, Chuck?

I haven't sat down and figured the cost to replace all of the paper caps in an R390A, but I don't think that it should cost much more than 25 or 30 dollars per receiver, then you're done with it. I'd imagine that those 400 volt and 600 volt Orange Drops will last longer than most of us will. One of the major problems I having right now is changing out of spec resistors in the R390A's. Most of my inventory of spare resistors has increased in value. ;-(

Date: Wed, 07 Oct 1998 10:08:53 -0300
From: laffitte@prtc.net (laffitte)
Subject: [R-390] Stewart-Warner R390A Brown Beauties of DEATH

My R390A from Stewart Warner has all of the "de rigeur" caps in the IF sub-chassis replaced. I had seen all the brown beauties there but never paid much attention since they did not show any leakage with the multimeter.

Just out of curiosity I took the IF module out and checked the brown beauties with a magnifier. Guess what! all are cracked and probably

leaking at high voltage!! Our humidity here is 70% average which makes it worse. They are all coming out and will be replaced with OD's. This also means that the RF subunit must also come out. Major surgery and complete recapping is at hand. As usual, I will post my findings as I go. I haven't removed an RF subunit in an R390A for a long time so my original manual will be followed step by step. Any recommendations from you guys will be more than welcome specially if there is anything else that I should replace in the RF subunit. This receiver has been working as is but it is the least sensitive ones of the R390A's that I have owned. The EAC just drives over it.

Date: Wed, 07 Oct 1998 08:50:40 -0600
From: "Eustaquio, Cal J" <cal.j.eustaquio@lmco.com>
Subject: RE: [R-390] Evil Capacitors

Have you notice any performance improvements of replacing those caps beyond increased reliability of the radio? Cal.

Date: Wed, 07 Oct 1998 09:39:36 -0500
From: "Dr. Gerald N. Johnson, P.E." <geraldj@ames.net>
Subject: Re: [R-390] Evil Capacitors

> There was another capacitor that Chuck said that he's seen leaky in some >radios that caused low audio output if I remember right. I'm pretty sure that it >was one of the metal bodied ones. I don't remember which one it was but from >what I gathered, it didn't take a hell of a lot of leakage to seriously affect the >audio output.

Any capacitor that's connected from a tube plate to a tube grid (same or different tube) is critical. If it leaks (and its got more voltage applied than most other capacitors in the radio) it upsets the bias on that grid making the tube draw more current. If its an audio output tube, that shortens its life, causes it to distort, and drives the output transformer more towards saturation to add more distortion. And with the typical output tube grid resistor of half a megohm, 2 microamps leakage is enough to change the grid voltage by one volt. When bias was only 8 or 12 volts that's significant. That's a leakage resistance of maybe 75 megohms, which your ohmmeter would say wasn't leaky... That's a sensitive spot! At that applies to almost every tube radio ever made, at least since they gave up using low level audio transformers...

Date: Wed, 07 Oct 1998 12:45:26 -0500
From: "Dr. Gerald N. Johnson, P.E." <geraldj@ames.net>
Subject: Re: FW: [R-390] List of Capacitors

Screen dropping resistors and plate feed isolation resistors in IF and RF

stages are often mistreated by leaky bypass capacitors.

Date: Thu, 08 Oct 1998 02:02:44 -0500
From: Nolan Lee <nlee@gs.verio.net>
Subject: Re: FW: [R-390] List of Capacitors

I hacked your list. I added the tolerances and working voltages for the original caps. Also added two missing ones on RF deck, C256 and C275, two missing ones on AF deck, C602 and C609. Oops, I almost damn near forgot the one on the front panel, C101. It's your list and you can do what you want with it, but if I was doing it, I'd give the original values as I've entered and then use (*) footnotes to add the comments on recommend values for audio performance, voltages for safety of filters, etc. This will allow someone that's not interested in mods to still find the list handy and makes it more orderly and professional looking. Need to get a few other people to look it over and see what we've missed. There's always something. ;-(<snip>

(see the list of caps in a later corrected posting)

Date: Thu, 08 Oct 1998 02:31:12 -0500
From: Nolan Lee <nlee@gs.verio.net>
Subject: [R-390] R390A Brown Beauties of DEATH

>As far as recommendations go, Chuck suggests desoldering the RF circuits >(getting the lead >out) and using in its place silver based solder, the object being to improve sensitivity by >making the circuits quieter. His video shows how it's done.

Short of mechanically removing the original solder with a file or by scraping with a razor blade or something, I don't see how you'll be able to do this. Sucking it or using wick still leaves the surface tinned with the original tin/lead solder. In addition, you still have regular tin/lead solder attaching all of the RF coil windings to the stanchions inside of the 25 or so cans on the RF deck. Those tiny little wires are very fragile. I use silver bearing solder in my old Tektronix stuff, but it came that way from the factory and I've seen ceramic terminal strips ruined by people that used standard solder.

>Some of the wiring appears hard to reach and it will be difficult to do a neat job.....

About like changing loads of capacitors or resistors. Patience is the key. And a steady hand. :-) I use a pair of smooth jawed stainless steel hemostats for bending the leads to shape. Sometimes I may set a part in place and remove and adjust the bends three or four times before I'm

happy with it and solder it in place. They come in handy for temporarily clamping wires out of the way too. You might want to make yourself a few "shields" to help protect wiring and other stuff when you have to solder or unsolder in a real tight area. I like to use different size little strips and squares cut from .015 brass shim stock. I'd imagine that some could be easily made with a good pair of scissors and a soft drink can.

>Hint: If you use primitive soldering gear as I do (Ungar stuff), use a Variac to regulate heat and minimize charring. I've found it makes a huge difference.

Yep, the Variac works good. I typically keep two irons hot when I screwing around with BA's: a 20W iron and a 60W iron, and a couple of different sizes and brands of solder.

Date: Thu, 08 Oct 1998 19:28:57 -0500
From: "Dr. Gerald N. Johnson, P.E." <geraldj@ames.net>
Subject: Re: [R-390] Why Sprague Orangedrops?

Mouser and DigiKey both have web pages and sell to Canada and both sell Sprague Orange Drops. The reason for the preference for Orange Drops is that after 40 years the first ones I ever bought still aren't leaky. Even when a sample got run through the wringer washer in my pants pocket. Vitamin Q's are pretty good capacitors, far better than the black and brown molded capacitors, but still not as good as Orange Drops. Orange Drops will show zero voltage on my tough leakage test. That's hard to duplicate.

Date: Thu, 8 Oct 1998 21:54:13 EDT
From: AviDov@aol.com
Subject: Re: [R-390] Why Sprague Orangedrops?

C-609 seems to be an 8mfd Tantalum by Fansteel
(p/n PP8B30A2 or Coll # 184 7003 00)

Date: Thu, 8 Oct 1998 22:19:46 -0400 (Eastern Daylight Time)
From: Norman Ryan <nryan@acpub.duke.edu>
Subject: Re: [R-390] Why Sprague Orangedrops?

Thanks for all your input-- much food for thought. C609 in the audio deck is that nasty little 8 mfd, 30 volt miniature electrolytic that apparently contains sulfuric acid. The acid causes total destruction of the cap over time and makes a nice little mess on the fibreglass terminal board as well.

Date: Thu, 08 Oct 1998 22:00:52 -0500
From: "Dr. Gerald N. Johnson, P.E." <geraldj@ames.net>

Subject: Re: [R-390] Better options to orangedrops

There is some argument about the quality of capacitors having an effect on the performance of the radio. Chuck Rippel notes that an Orange Drop has better performance for the mechanical filter coupling capacitor than a disc ceramic at the same position. It could be that the inductance of the conventionally wound capacitor helps resonate the capacitor and filter. That may also be true for IF bypasses. There used to be a black beauty actually made with intentional inductance to series resonate at 455 khz.

The extended foil capacitor may not supply that inductance where the circuit constants were originally expecting that inductive component of the paper capacitor used at IF or higher frequencies.

For other applications, the plain wrapped or extended foil capacitors may not have detectable effect on the radio's performance. Though in an SB-110A when I replaced low quality capacitors used for high frequency roll off around the output tube, I found it lead that tube to have high frequency and RF parasitic oscillations which I only cured by installing resistors in series with those higher quality capacitors. There I was replacing aluminum electrolytics with tantalums. Extended foil capacitors with their near lack of inductance and resistive losses could conceivably cause the same problem.

We do have some 40 years of proven orange drop reliability to count on.

Date: Thu, 08 Oct 1998 22:02:26 -0500
From: "Dr. Gerald N. Johnson, P.E." <geraldj@ames.net>
Subject: Re: [R-390] Why Sprague Orangedrops?

I've not detect much to discriminate between makes of oiled paper capacitor. Leakage seems always out of line when they are a couple decades old or older.

Date: Fri, 9 Oct 1998 07:13:49 -0500
From: Laird Tom N <LairdTomN@jdcorp.deere.com>
Subject: [R-390] C-609 description

C609 is a 8uF 30 volt +50-15% tantalum slug wet anode 85 degree C capacitor. MIL-C-3965 spec CL44BH080TP3. Sprague 132D805C5030U0. ITT MA8MA. Fansteel PP8B30A2. A 10uF at 50 volt axial aluminum will work fine.

Date: Fri, 09 Oct 1998 10:43:01 -0400
From: Gary Kaufman <gkaufman@bu.edu>
Subject: Re: Subject: [R-390] Why Sprague Orangedrops?

Another source of very reasonable priced yellow tubular axial caps is Bob's Antique Radio and Electronics. They advertise in Antique Radio Classified. They take checks, and ship very promptly. They only sell in lots of 25 pieces however.

Value (all 630V axial)	price/25 postpaid
.001	$6.00
.0047	$6.25
.0068	$6.35
.01	$6.50
.022	$7.00
.033	$7.25
.047	$7.50
.1	$8.00
.22	$15.00
.47	$20.00

They also have 22, 33, 47uf 160v axial lytics and 10, 22, 47uf 450v axial lytics.

Bob's Antique Radio and Electronics.
111 East 29th St.
La Grange Park, Illinois 60526
(708) 352-0648

I have no relationship with the company, but am just a satisfied customer. While I am new to the R390/R390A arena I've used them for several years in other tube based gear and have been very pleased.

Date: Fri, 09 Oct 1998 14:38:55 -0500
From: "Dr. Gerald N. Johnson, P.E." <geraldj@ames.net>
Subject: Re: [R-390] Sprague "orange drop"

While not as leaky as black beauties, I have had a collection of yellow jacket capacitors that lead me to believe ALL capacitors not Orange Drops are excessively leaky... especially those with molded jackets.

Date: Mon, 12 Oct 1998 12:47:00 -0700
From: Bob Bennett <rjb@lynden.com>
Subject: [R-390] Orange-drop angels - just one more question...

I just referred to the SBE home page (home of the Orange Drops) and read their interesting comparison of their Film/foil capacitors (ie, Orange Drops) vs metallized film capacitors. (URL is www.sbelectronics.com/specs.htm) Impressive - I now know that the Orange Drop capacitors have higher heat dissipation, higher peak current

capability, and allow a faster duty cycle. So here is a question for the heavyweights on this list:- I accept that the OD's are near indestructible (apparently you can even leave them in your pockets when you drop your tweeds into the washer), but does any of the rest of this technical stuff have any relevance to the world of 390's and SP600's? Compared with say the AES polypropylenes and polyesters? Or is it only of relevance to the golden eared guys?

Date: Mon, 12 Oct 1998 14:44:16 -0500
From: "Dr. Gerald N. Johnson, P.E." <geraldj@ames.net>
Subject: Re: [R-390] Orange-drop angels - just one more question...

Once I put in Orange Drops I don't have to fix paper capacitors in that radio ever again. Anything else I don't have that trust yet. And I have a great distrust of anything waxed or molded from the 50s and 60s and before. Even if never used. Been there, done that, burned up parts, don't want to repeat that learning again. Remember it only takes a little leakage current (microamp or two) in an audio coupling capacitor to double the plate current of the following stage which leads to tube damage or distorted audio (50% distortion, not golden ear threshold differences) and even less leakage in AVC circuits to cause overdrive of the last IF stages to get that same effect. A little more leakage in a screen bypass capacitor (few hundred microamps) and the screen dropping resistor is hacking twice or three times rated current and then 4 or 9 times rated dissipation which leads to fried resistor. And in the mean time, poor receiver performance from low screen voltage. Low gain early distortion.

From 40 years of using Orange Drops I trust them to continue to serve me faithfully without minor leaks or opens. I don't know about other Johnny come lately capacitors. They might be better, they might be worse. Their manufacturer might not care as much. I'm not going to say that you needn't experiment, but for me its Orange Drops until I can't get Orange Drops.

Date: Fri, 16 Oct 1998 20:16:53 -0700
From: Philip Atchley <ko6bb@elite.net>
Subject: [R-390] R-390 Re-cap

I've followed this thread with great interest, and since my R-390A (1956 vintage) works quite well but.....does occasionally make a very minor crackle or two that is generated in the radio I'm going to do a re-cap. (Tubes have been replaced) After checking my various catalogs and AES on-line I'm going to order all 105 degree metallized Polypropylene caps and electrolytics (including the tantalum one which "rots") from Mouser. The "Orange Drops" may be considered best but I question if they may not be "old stock". Also I'm VERY budget limited and the price is better. Still

must be better than what is in there.... I will use discrete Electrolytics for the power supply if I can manage to fit them in somehow, I cannot afford to have them re-potted. My old receiver will still be improved .

I wish to thank everyone who increased my awareness of "leaky caps". I've been in electronics 45 years but never realized how badly they degrade over the years. I've always just replaced the "failures"....

Date: Sat, 17 Oct 1998 01:21:00 -0500
From: "Dr. Gerald N. Johnson, P.E." <geraldj@ames.net>
Subject: Re: [R-390] [R-390A]Recapping IF

By replacing the leaky screen and plate supply bypass resistors you got the screens back up to rated voltage. Likely some were nearly turned off. And the AGC works better too. You might want to go back and check the screen resistor values, they might have been overheated a little or a lot by the leaky capacitors.

Date: Sun, 18 Oct 1998 21:23:42 -0500
From: "Dr. Gerald N. Johnson, P.E." <geraldj@ames.net>
Subject: Re: [R-390] Orange Drops of Life

The inductance depends more on how the leads are connected to the rolled capacitor. The AES capacitors are extended foil, and are much lower inductance than Orange Drops which are not extended foil, but inserted strips occasionally for connections.

Date: Tue, 20 Oct 1998 05:37:11 -0700
From: "Greg W. Bailey" <greg.bailey@sdsu.edu>
Subject: [R-390] A "recapping" experience

Recently I went through the "recapping exercise", or should I call it an initiation? Naturally I took some data which I thought I would share with my fellow "listees". First, I'm embarrassed because my graduate student didn't get the model number of the HP CRL Bridge (Capacitance-Resistance-Inductance) that was used in the tests. However, if requested, I will put on the List later. (Just for the record, the student will be flunked!!)

Procedure: The IF sub-assembly was removed from my (thank you Ben Wallace) 1967 EAC 390A. The receiver was in proper operating condition when the chassis was removed. Using Nolan's list (or whoever generated it?) the various noted capacitors were identified. Each capacitor was removed with cutters to eliminate any thermal damage caused by unsoldering. After removing the capacitor, it was connected to the CRL bridge and a capacitance measurement taken. Upon completing the

measurement, a break down voltage test was attempted. The voltage used was equal to Mfg. suggested voltage as noted on the case of the capacitor. When in doubt, a 300 WVDC potential was used..

Physical appearance of the capacitors was noted with the following results:

(1) 3 urine yellow (I call as I see'em) Aerovox 0.033 uFd +/-20%,
(2) 2 West-Cap metal case 0.1 uFd 200 WVDC,
(3) 2 West-Cap metal case 0.1 uFd 100 WVDC,
(4) 1 West-Cap metal case 0.22 uFd 100 WVDC,
(mounted on rear of front panel)
(5) 1 West-Cap metal case 0.01 uFd 300 WVDC,
(6) 1 West-Cap metal case 0.033 uFd 300 WVDC.,
(7) 7 unknown mfg. brown molded body
measuring 0.375"D X 1.0"L 0.01 uFd 200 WVDC.

Results: Capacitance
(1) 0.0307, 0.0305, 0.0304 (2) 0.107. 0.092 (3) 0.110, 0.101
(4) 0.223 (5) 0.0097 (6) 0.0293
(7) 0.089, 0.116, 0.107, 0.0836, 0.091, 0.089, 0.106

Results: Voltage break down
No capacitor exhibited break down, leakage, etc.

After initial test, all capacitors were increased to +100 voltage over their rating and no breakdown was noted.

Results: Appearance
None of the capacitors were physically deformed, i.e. leaking, cracked, etc.

Results: Operation
There was no perceived change in operation of the 390A.
Test of the "noise + 10 dB" sensitivity test showed no improvement.

Results: Interesting. Recently I read on the List that another person who "recapped" their receiver noted the hardware securing the ground lugs had loose nuts. Just for the edification of all those reading thus far in my epistle, be comforted that my nuts are not loose! (quoting Nolan ... Grin).

Date: Tue, 20 Oct 1998 11:12:47 -0500
From: "Dr. Gerald N. Johnson, P.E." <geraldj@ames.net>
Subject: Re: [R-390] A "recapping" experience

You say "no leakage." What's your criteria for leakage? These capacitors

should show some leakage even if only fractions of a microamp. Remember that a microamp or two of leakage is all it takes to prevent AGC action or to change the grid bias of an audio tube by a volt. So leakage measurements need to be very sensitive.

Date: Wed, 21 Oct 1998 20:21:11 -0500
From: "Dr. Gerald N. Johnson, P.E." <geraldj@ames.net>
Subject: [R-390] Re: A recap on "Recapping"

No problem Greg, you didn't state your criteria for saying "no leakage." Some leakage tests are not as sensitive as I prefer. One microamp threshold is marginal in vacuum tube circuits. I say this because 1 microamp to the grid of an audio output tube with a half meg grid resistor will change the bias half a volt. When the bias was only 8 volts to begin with as is common with many US output tube designs (its interesting to notice that many European tubes require a much higher bias) that half a volt change can begin to upset the operating capabilities of the tube leading to greater asymmetrical distortion, increased plate current and eventually shorter tube life. In the AGC circuit which often has several megohms of series resistance, a microamp of leakage (and many times I've seen capacitors that didn't have a linear leakage resistance) can mean several VOLTS of AGC change. That's significant. My leakage test is tougher, I use a VTVM for the leakage indicator on the lowest scale and prefer leakage under a volt. That's under 0.1 microamp. I like Orange Drops because they easily pass that test. I don't like the older oiled paper capacitors because in MY experience with old radios essentially every capacitor I tested failed to meet my leakage test criteria. Sure, an IF screen bypass with a 56K series resistor isn't going to lower the screen voltage much with an additional microamp of current, but that microamp of current in the capacitor with 150 volts applied means 0.15 milliwatts of dissipation, likely at some point within a thermally insulating mass which can lead to more rapid degradation. Which leads to capacitor failure and resistor failure and failure of the receiver to perform well when the screen voltage has been dragged to near zero.

I've been working on tube radios for something like 45 years and I stand by my opinions and experiences. There may be some batches of 390A capacitors that are not following the same paths as the other radios I have experienced. At the same time I have noticed that some users of 390A have detected and reported significant improvements in receiver performance after a complete swap of paper capacitors.

When its many times harder to troubleshoot the radio than to take a module out and replace all the capacitors, I think its preferable to replace the potential troublesome parts and save the circuit tracing needed to troubleshoot the radio some time down the road.

Date: Wed, 21 Oct 1998 19:41:06 -0700
From: Philip Atchley <ko6bb@elite.net>
Subject: [R-390] re-cappin' almost done...

Today I recapped my IF deck and the AF deck. While I have the parts on hand I do not intend to do the RF deck till I get the manual. My Radio and the results..... It is a 1956 Motorola, all modules appear to be original 1956 dated units. Even the filters were dated 1956. IF Deck Collins, AF Deck Motorola. All parts "appeared to be original". I used the xicon polypropylene caps and xicon filters from Mouser as price was of major importance to me, I used all 400 volt Polypropylene to replace the paper caps, except I used 630V units for the Mechanical filter and in the AF coupling circuits. They all fit very well in place of the brown beauties of death.

Now...I checked every cap for value and leakage (at working voltage) as I removed it. Every one tested good, even the tantalum one that "rots" was good. Filters checked good and not leaky which was a surprise as the radio had "hum" when I first got it that went away after some weeks....

Results??? The radio did gain about 2 dB improvement in "front end noise" per Ripple's test at 15.2mHz. "S" meter went from 40 on the calibrator at 15.2mHz to 60dB under identical test conditions before & after. So I did gain a considerable amount of IF gain even though all caps tested good.

Now... I have a bunch of "Brown beauties" and Vit Q's with short leads that test good. Anybody want em???

Date: Wed, 21 Oct 1998 19:50:49 -0700
From: Philip Atchley <ko6bb@elite.net>
Subject: [R-390] Re-cap almost done cont..

One thing I forgot to mention. Since the original filters tested good I did not choose to destroy them. I was able to mount all the xicon filter caps under the audio chassis with room to spare. In fact I have some "390" standoffs that I removed from a scrap IF strip and used existing screws to mount em.

Mounted the three 33uF ones over on the end away from the tubes (that empty area where some models must have a relay mounted.) The two 47uF units fit nicely on the socket that usually holds the 2X45 unit. Just clears when installed in the radio and they are secure enough you needn't worry about they moving about. Keep them away from the hot resistors though.

Date: Wed, 21 Oct 1998 20:57:18 -0700
From: Philip Atchley <ko6bb@elite.net>
Subject: Re: [R-390] re-cappin' almost done...

It may be, I'm not disputing' it. I use a Heathkit IT-11 bridge that can be set to any voltage 3 to 600 VDC and uses an "eye tube" to display leakage. I'd suspect the eye tube grid would be pretty high impedance and would detect leakage that would affect tubes. But...who knows. It has found plenty of "leakers" before. All caps "looked" good, no cracks, leaking gunk etc. But I know that's no positive indicator.

All I know is I'm pleased with the re-cap results. Radio "seems" quieter also. Only a hiss with no pops or crackles when it hasn't an antenna. (It would give an occasional small pop or crackle with no antenna/signal which was not audible with normal signals)

Date: Wed, 21 Oct 1998 21:53:48 -0700
From: Philip Atchley <ko6bb@elite.net>
Subject: Re: [R-390] Re-capp almost done cont..

The whole RF deck will come later, I need manuals, spline tools etc. No particular hurry now, it is my primary receiver now so I want everything right. I'm not a stickler for "originality" but do go for quality work. By the way, if anyone's interested, (I've heard mention of this) the xicon caps are brown, don't look like "candy" and are quite small. OD's are possibly better, but I doubt that anybody can tell the difference. The xicon have 30G resistance specs if I recall correctly.

Date: Thu, 22 Oct 1998 13:00:45 -0400
From: "Chuck Rippel" <crippel@exis.net>
Subject: [R-390] re-cappin' almost done...

Depending on the vintage of the IF deck along with a quantity of other variables, you could have cleaned out a single of nest of caps which were leaking. While I have never seen that problem and sure as such (my seeing or not means little. What's 500 radios out of 65,000?) its certainly very, very possible and your post did not surprise me. Sounds more like congrats are in order for rooting out the problem.

Date: Sun, 27 Dec 1998 19:21:03 -0600
From: Nolan Lee <nlee@gs.verio.net>
To: W Li <wli@u.washington.edu>
Subject: Re: C-531

> The list was an invaluable aid to me. Thank you for taking the trouble to

make it up.

I appreciate you pointing it out. I've corrected the list and will repost it on the R390 reflector. :-

>This is a great reflector as I (slowly) clean up my unit. One question
>about DeOxit, do you just shoot the stuff in a tube socket, and then
>replace the tube after wiggling it around a bit? Is it OK to leave the
>tube in a moist socket? Or do you remove the tube, and allow things to
>dry out completely? (Dumb query, but I've never used DeOxit before).

I've never used it either. I wouldn't wiggle the tube around though, it'll loosen the terminals in the socket. I'd just pull the tube straight out and press it straight in a few times. :-)

Date: Mon, 28 Dec 1998 10:26:33 -0600
From: "Dr. Gerald N. Johnson, P.E." <geraldj@ames.net>
Subject: Re: Variac

<snip> The choices on Orange Drops are polyester, not polystyrene, and polypropylene. My long term experiences have been with the **polyester.** I have a little less confidence in the polypropylene, e.g. no long term experience. There have been capacitors made with polystyrene but because of its low dielectric constant, they tend to be too large for audio service.

Date: Mon, 4 Jan 1999 10:27:55 -0500
From: "Jim Walker" <jwalker@atus.com>
Subject: [R-390] R390a Capacitor List

As is often the case, my original intention to change just C549 and C553, (mechanical filter protection modification) turned into a complete recap of the IF deck.

I finished the re-capping of the 67 EAC IF module over the holidays. I can tell you the 600 volt Orange Drops can be reasonably fit into the module without significant deviation from the original layout. It does require patience and a long soldering tip for the "under BFO" capacitors. I found Antique Radio Supply offers two versions of the Orange Drops, the original 715P and the newer 716P type. I found the newer **716P 600 volt caps** to be physically smaller than the 715Ps.

I have been wondering about the "black beauties of death" because I couldn't find any in my R-390a. I saw pictures of them in my Army Tech Manual but none in the IF module. All of the caps I changed were either AEROVOX or WEST-CAP. The WEST-CAP looked like quality capacitors;

however, I didn't do any leakage checks.

I found two variances from Nolan's list, which I found to be of great help in the organization of my effort. C545 was a 400v AEROVOX vs 300 volt. C547 was a 100 volt WEST-CAP vs a 200 volt cap per the list. My Army TM didn't have a parts list so I couldn't verify what was originally supposed to be in the module.

I have two questions about the audio deck I'd appreciate feedback on:

- - What is a suitable substitute for C609 8uf/30WVDC?
Mine was leaking badly.
- - Is there a trick to replacing the caps on the audio board? There does not appear to be sufficient clearance on the PCB to put Orange Drops.....

Date: Mon, 04 Jan 1999 14:22:31 -0600
From: Nolan Lee <nlee@gs.verio.net>
Subject: Re: [R-390] R390A Capacitor List

>I finished the re-capping of the 67 EAC IF module over the holidays. I can
>tell you the 600 volt Orange Drops can be reasonably fit into the module
>without significant deviation from the original layout.

It's a lot of work. :-) I used 400 volt rated ones for the 0.1's and the .033's. I did use 600 volt rated .01's because of their smaller physical size. Even using the 400 volt rating, there's a pretty comfortable margin.

>It does require patience and a long soldering tip for the "under BFO" capacitors.

I removed the BFO and the shaft for the bandwidth switch. It's a lot easier. :-)

>I found Antique Radio Supply offers two versions of the Orange Drops, the >original 715P and the newer 716P type. I found the newer 716P 600 volt caps to >be physically smaller than the 715Ps.

I used the 715P design. There's also a variety that has copper leads rather than the plated steel ones like the ones I used. I'd imagine that the copper leads are a hell of a lot easier to work with. :-)

>I have been wondering about the "black beauties of death" because I >couldn't find any in my R-390a. I saw pictures of them in my Army Tech >Manual but none in the IF module. All of the caps I changed were either >AEROVOX or WEST-CAP. The WEST-CAP looked like quality capacitors;

>however, I didn't do any leakage checks.

Actually, they were the "brown beauties of death". <grin> I've had a lot of problems with them. I've got a can of dead ones around here that I've removed over the last few months. Out of probably 4 or 5 dozen, I've only had maybe three of four that weren't leaky.

>I found two variances from Nolan's list, which I found to be of great help
>in the organization of my effort. C545 was a 400v AEROVOX vs 300 volt.
>C547 was a 100 volt WEST-CAP vs a 200 volt cap per the list. My Army TM
>didn't have a parts list so I couldn't verify what was originally supposed to be in the module.

My EAC also had the 100 volt rated West-Cap in the IF deck. The voltage specs that I posted on the cap list were out of the 1970 Navy manual for the R390A.

>I have two questions about the audio deck I'd appreciate feedback on:
>What is a suitable substitute for C609 8uf/30WVDC? Mine was leaking badly.

It cost me a few dollars but I went back with a Sprague 150D series metal cased 10mf tantalum capacitor with a 50 volt rating, I think it was. It's in the rack or I'd take a look to confirm, sorry. They'll live a lot longer than a conventional electrolytic will. It's funny, but every one of the original tantalums that I've tested, including my three 1955 Collins AF decks, all tested good. I changed them anyway. One less thing to have to worry about a few years down the
line.

>-Is there a trick to replacing the caps on the audio board? It doesn't
>appear to be sufficient clearance on the PCB to put Orange Drops?

I didn't use Orange Drops everywhere on the AF module. I used the .022 OD's in the two locations that Chuck pointed out, an OD to replace the cap that's on the chassis rather than the little board and NOS glass seal Vitamin-Q's in the other locations after I tested them for value and leakage. I didn't like the way that the larger value OD's fit on the board.

Did you check the 2mfd 500 volt oil filled can (used in AGC circuit) for leakage? I had never seen one of those bad until just recently. I found two of them that puked. ;-(

Date: Mon, 4 Jan 1999 15:42:10 -0500

From: "Jim Walker" <jwalker@atus.com>
Subject: Re: [R-390] R390a Capacitor List

Regarding your question about improvement in receiver performance after doing the IF recap: I know I should have addressed this point in my posting; however, the fact of the matter is, the receiver was working fine ever since I acquired it in 1978. I have a SP600-JX loaded with "black beauties" that works just fine too. So far, I've left that alone. I never did any sort of sensitivity measurement so have nothing to baseline my result with. When I put the deck back in the receiver on Saturday, ten meter CW was either really wide open or there was a noticeable improvement in sensitivity. The perceived improvement could have been psychological though, just to validate the time and expense of doing the recap. It seems like everyone who does the IF recap rants and raves about the vast improvement but its tough to judge when, in my opinion, the receiver was working pretty good to begin with. I mostly did the recap out of curiosity and, as I said earlier, the project kind of assumed its own life. Mostly it was Nolan's fault when he published the capacitor list. It was also easy to get the IF deck in and out and to do the job. I now have cornered the orange drop market in North East Ohio.

Date: Mon, 04 Jan 1999 19:44:57 -0500
From: John Harvie <jbharvie@erols.com>
Subject: Re: [R-390] R390A Capacitors

For the tantalum capacitor I used MOUSER part number 74-150D50V10. This part is a 50 volt, 10 mfd solid tantalum capacitor.

See: http://www.mouser.com/detail.cfm?MPart=74-150D50V10&CustRef=

I am sure other similar parts would also work. My experience has been that the axial lead, yellow color, metallized film, polypropylene type capacitors work great when replacing the "Brown beauties", Vitamin Q and similar type of capacitors in the R39xx type receivers. I have "blanket replaced" all existing "Brown beauties", Vitamin Q and similar type capacitors and have been operating 2 R390A's and one R392 with absolutely no post replacement (capacitor related) problems noted. True I likely have not squeezed the last couple of 1/10 micro-volts out of the receivers but it's been fantastically fun and is still fun. There could be previous statements that some of the "new arrivals to the group" might interpret as a "shared group consensus" that to use "anything other than a Orange Drop replacement capacitor" is "less" than OK and is "something" to be discouraged. Lets face it what we are replacing for the most part is a "failed/failing" 45 year old, plastic encapsulated, paper type capacitor. Indeed my 1967 EAC RF deck also used a "yellow" AEROVOX, 0.033mf,

400 volt film type capacitor. True, metallized film capacitors are not orange drop type capacitors, true, they reflect a modern day capacitor fabrication technology not the 30+ years of orange capacitors. True, items such as "lead inductance", overall "device resistance", "dielectric constants" and other such technical factors are important when they effect the circuit. Items such as MTBF and reliability are a little harder to persuasively argue unless you examine the current data available. It is a fact that metallized film capacitors are qualified and are used today in space flight applications and as such would appear to have exhibited compliance to rigorous performance standards.

"It may be that for pulse switching or power applications Orange Drops capacitors might "out-perform" the metal film type capacitors however these applications are not what form the basis of the R39xx capacitor usage under this discussion." I would submit to the groups experience an evaluated position of which specific "Brown beauties", Vitamin Q type capacitors in the R390A circuits form a part of a "critical nature" application where the use of metal film capacitors can be determined to be detrimental. I am unaware of any. (This might be similar to the sonic implications such as the use of copper cables manufactured with a lower oxygen content and beyond the scope of my input.) At some point each of us needs to assess the facts and determine if we feel comfortable in using a capacitor "A" or capacitor "B". One of the beauties of this forum is the personnel experience on these marvelous radio receivers. I for one have traveled to the position that there is no compelling technical justification to preclude the use of the axial lead, yellow color, metallized film, polypropylene type capacitors in satisfying the requirements of the task of restoring to acceptable service the R39xx series receivers. I know this is not a view shared by all. Wonderful! Bottom line: I have found that metallized polypropylene type capacitors are 1/2 to ~2/3 the price of Orange Drops, they are quite smaller in size and thus fit in all areas of my receivers, and that they have worked well for me.

Date: Tue, 5 Jan 1999 10:10:12 -0500
From: "Roy S. Morgan" <roy.morgan@nist.gov>
Subject: RE: [R-390] R390a Capacitor List

C-609: Use any modern electrolytic of 8uF or more and 10 volts or more. That capacitor operates at about 2 to 3 volts, so the 30 volt rating was not needed.

Audio caps: there are some modern film caps which are longer and thinner than most caps of the same capacity and voltage. You have to look to find them - sorry I don't have DigiKey numbers or the like. These thinner caps are needed to fit on the terminal board. Alternatively, mount the replacement caps UNDER the board. there is room under the board for

larger caps. Happy audio!

Date: Tue, 05 Jan 1999 22:10:24 -0500
From: Tetrode <tetrode@m9.sprynet.com>
Subject: Re: [R-390] R390A Capacitors

"One of the beauties of this forum is the personnel experience on these marvelous radio receivers. I for one have traveled to the position that there is no compelling technical justification to preclude the use of the axial lead, yellow color, metallized film, polypropylene type capacitors in satisfying the requirements of the task of restoring to acceptable service the R39xx series receivers. I know this is not a view shared by all. Wonderful!"

You're not the only one using the "yellow" caps, I am presently going through a recap exercise now. I signed onto the group last September and have read with great interest all the component engineering going on regarding the caps. I tackled the audio deck first using some OD's that I had on hand--sat them up nice and straight on the little board in place of the brown beauties, then upon setting the deck back in the radio, swore up a storm as the caps bonked up against the chassis. Duh! (this must be a classic R390A newbie mistake). Had to take all the caps out, put new ones in, bend the leads back up against their body to clear the adjacent components, and lay them flat. The lead bending also broke the epoxy dip seal on the leads, probably not enough to cause harm, but its something to avoid, and visually unpleasant. (Too much lead seal breakage at work causes the QC folks to go into reject mode). At this point I started looking for some good axial caps for the IF deck and found that they are in the minority. Radial lead caps are best for PC boards which of course is how most electronics is manufactured these days. So I ordered both the yellow axial caps and the OD's from AES. Upon seeing how large the 600 V OD's were I decided to go with the yellow caps. Nolan's suggestion to use the physically smaller 400 V units definitely makes sense too, maybe I'll try them on the next deck I do. So far so good with the yellow axials-the fit is excellent. Haven't finished yet but anticipate good results. Polypropylene is a superb capacitor dielectric, and the metallized plating works fine for practically any application other that where high AC current is involved, which is certainly not the case with receiver circuits. The ONLY caution I might provide to anyone using these caps is that unlike the OD's which have a hard epoxy case, these axials have cases which are all plastic are easily melted from a soldering iron tip. I accidentally wrecked a couple caps-you could see the aluminum through the melt hole. Now, to beef up the caps, I put clear 3M heat shrink tubing over the case and shrink it down. The caps are now resistant to all but intentional abuse. Incidentally until today I did not know the manufacturer of the yellow polypropylene caps from AES, the only hint was "ic". AES didn't know either. After some

web surfing I found them to be the MPW series made by Illinois Capacitor, Inc. They appear to be a high quality outfit, and also perform 100% test on their caps. URL is www.illcap.com/. Another interesting URL found along the way was a huge cap manufacturer index at http://www.faradnet.com/company/companix.htm.

Date: Wed, 06 Jan 1999 23:46:07 -0500
From: John Harvie <jbharvie@erols.com>
Subject: Re: [R-390] R390a Capacitors

OK- Thanks for the story on a good experience and yes the outer jacket of heat shrink tubing where necessary is a good idea. I have used the Polyolefin flexible heat shrinkable tubing with good luck. It has a higher melting temperature (~135C) than the PVC product (~105C).

Mouser sells it by the 4' length in a good assortment of sizes, and colors including clear. I have found that the 1/16" also makes a good sleeving for component leads. Preshrink and fit and or slip on and shrink. Yes, I found that Illinois Capacitor, Inc. is responsive.. they print and will send to you a nice catalogue if you ask for it.

The MPW product line is described on page 100
630 volt, 0.1mfd URL is
http://www.illcap.com/capacitors/MPW/104MPW630K.html

630 volt, 0.01uf URL is
http://www.illcap.com/capacitors/MPW/103MPW630K.html

630 volt, 0.033uf URL is
http://www.illcap.com/capacitors/MPW/333MPW630K.html

Date: Thu, 7 Jan 1999 06:43:16 -0500
From: "Ed Tanton" <n4xy@mindspring.com>
Subject: RE: [R-390] Black Beauties

Hello All... I replied about this to someone privately, but I guess I need to mention it to everybody. First, let me say that changing the black beauties to Orange Drops is fine with me. I (eventually) will do it for everything I have... BUT I have both a TO-4 and a TO-5 Sprague Cap Checkers... Sprague pointedly tells you in their manual that THE calibration cap(s) are "Black Beauties". Both work quite well. There must be SOMETHING(S) wrong with BB's, whether it is a tendency to a high percentage of bad batches, under-design, or really just POOR performance w/high failure rates. Their bad reputation may or may not be truly deserved in every case... but I'll swap mine out the 1st chance I get anyway. On everything that has 'em, sooner or later. Mylars, metallized polyesters, and Orange Drops (typically @

630VDC) just do not cost enough to change my mind about the surgery.

Date: Thu, 07 Jan 1999 08:05:51 -0700
From: "Eustaquio, Cal J" <cal.j.eustaquio@lmco.com>
Subject: RE: [R-390] Black Beauties

I have to agree with Ed regarding the changing out of the black beauties. Several months ago, I discussed about not changing out caps unless needed. Those black beauties are a major exception. Several years ago, I had inadvertent keying of a Ranger. It turned out to be a "black beauty" located somewhere in the keying circuit. Apparently, the heat from the 6X5 rectifier tube caused the problem. As the xmtr warmed up, the Ranger started to key about three minutes after all tubes had lit. I verified that the cap was the culprit by putting a heat shield between the cap and the tube. The problem went away when I used a quick blast of "cold mist" to cool the unit. I changed out the cap to a disc ceramic and never had the problem again. Another occurrence happened when I inspected the chassis of an "All-American 5" broadcast radio. I looked at the bottom and there was a black beauty almost split from end to end. Well, I thought to myself "since this cap isn't in a critical part of the circuit, I won't worry about it". Additionally, the radio had been playing for quite a while since I had it. Wrong guess. The next time I turned it on, about a minute later, I heard this "fizzzzz.. POP!!!". It was the cap. Nothing else was hurt, however. But I should have known better. So, change them out whenever you can. My son, you are obligated under the code of boatanchor "bushido" to terminate these things without prejudice! 73. Cal.

Date: Thu, 7 Jan 1999 10:12:47 -0500
From: "Roy S. Morgan" <roy.morgan@nist.gov>
Subject: RE: [R-390] Black Beauties

What is NOW wrong with black beauties was not wrong with them when they were manufactured, tested, and selected for a wide range of equipment manufacture.

Essentially, the dielectric is oil-impregnated paper and the case is some kind of molded material. The state of the art in materials science and technology has progressed a LOT since those caps were made. The chemistry and materials manufacturing methods used then simply added up to basically guarantee failure due to leakage for that combination of materials over the time period since then. It was not poor workmanship, high frequency of bad batches, ignorance of then-current chemistry or manufacturing methods, under-design, poor component engineering, or bad equipment design or manufacturing methods.

Some of the black beauties in my SP-600 have actually split their cases

end to end from expansion inside. I suspect that moisture, and possibly chemical breakdown of the oil, have made the innards of the things swell up. That's to say nothing about the arcing and leakage they exhibit. My SP-600 is waiting for complete cap replacement. A while back I assembled kits of modern caps, including filter caps, and sold them for the SP-600. I have enough left over to do both my SP-600's. I understand that you can expect modern capacitors to last a hundred years or more. I want to be listening to an R-390 and SP-600 thirty years from now while in the retirement home where they won't let me have soldering irons anymore.

Date: Thu, 07 Jan 1999 12:47:03 -0400
From: laffitte@prtc.net (laffitte)
Subject: [R-390] Brown and Black Beauties

Following up on the Black Beauties caps thread I have to say that each one that I have found has been leaking enough to cause trouble. Just replace them when you find them regardless of how good the unit works with them. Eventually it will work much better and you will have peace of mind. Even non-cracked units show some leakage on a good cap tester. Their time has come. Even micas are starting to be more troublesome than usual specially those in plate coupling circuits. I think it is a good idea when working on the RF deck of the 390 to replace all brown beauties, all coupling caps, the Z216 100uuF micas and all 2.2K resistors (check the rest of course). This should be a de rigeur procedure for the RF deck.

Date: Thu, 07 Jan 1999 14:46:35 -0800
From: dma@islandnet.com
Subject: RE: [R-390] Black Beauties

As I've said before, I always change both the brown and black tubulars. For the first fifty or so, I tested everyone after removal, and maybe 1 in 25 was good. I've noticed that a lot of the plastics and rubbers used in 1960's electronics haven't stood up. I have R-390A can electrolytics from Collins decks (and that have a 1956 date on them) that have perfect seals, but ones from the early 1960s that are hard and cracked. Someone who knows something about these materials can probably explain what happened. But I suspect that materials that seemed very good at the time revealed hidden flaws over the years. The Black (& Brown?) Beauties were probably well made. But the case material didn't stand up. I've found hairline cracks in many of the ones I've tested, so that moisture could enter. In the environment a lot of these radios worked in this would be bad news.

Date: Thu, 07 Jan 1999 17:21:03 -0600
From: "Dr. Gerald N. Johnson, P.E." <geraldj@ames.net>
Subject: Re: [R-390] Black Beauties

There was a time period in the early 60s when neoprene weren't well made and didn't last. There also was a BIG batch of GE Pyranol often used in capacitors that was faulty and aged badly causing capacitors to fail early. I don't think black beauties had it, because they didn't have its odor. I've found many bad paper capacitors that didn't have and visible cracks. It isn't the case, it's the guts.

Date: Thu, 07 Jan 1999 19:59:33 -0600
From: Nolan Lee <nlee@gs.verio.net>
Subject: RE: [R-390] Black Beauties

>As I've said before, I always change both the brown and black tubulars.....

Cheap insurance that will probably save you untold hours of trouble shooting weird problems in the future. I still test them just for kicks after I remove them. Almost all have been leaky, but I've chatted with a few people that have changed all of them out and then tested them only to find all of them test just fine. There doesn't seen to be a pattern to their failure. I'll continue to be paranoid and change them, just to be safe. :-) <snip>

>The Black (&Brown?) Beauties were probably well made. But the case material didn't stand >up. I've found hairline cracks in many of the ones I've tested, so that moisture could enter. In
>the environment a lot of these radios worked in this would be bad news.

Many of the ones that I've removed have had those cracks, usually very close to the molded seams. ;-(I've seen a bunch of the BB's in early 1960's HP stuff. I guess that for their day, they were a good cap.

Date: Thu, 7 Jan 1999 20:03:28 -0600
From: "Craig L. Anderson" <w9cla@spacestar.net>
Subject: [R-390] Orange Drops et al

I don't understand the penchant for the old Sprague "Orange Drop" caps. First of all, Sprague sold the line and no longer makes them. A little company in either Vermont or New Hampshire now markets the "Orange Drop" name. I was a Passive Component Engineer in the Aerospace Industry and I really don't understand the hype about Orange Drops. They are made with old technology and frankly, the newer "yellow" metallized film caps are better and much more tightly controlled than the older "Orange Drops." I think many of you are too wrapped up in the name.

I don't use Orange Drops for a variety of reasons, and have used the much

more reasonably priced metallized film axial leaded devices. The main difference in the construction is how the leads are welded to the film. Again, I think it has been mentioned before, we are not dealing with high frequency pulse currents. These [Orange Drops] might be a good fit in "snubber" circuits or horizontal flyback applications but the kinds of applications we see are not prone to excessive current spikes and Orange Drops are not practical considering their radial lead configuration and price.

Date: Thu, 07 Jan 1999 15:09:56 -0800
From: dma@islandnet.com
Subject: Re: [R-390] Brown and Black Beauties

<snip> Everyone has different thoughts on this, but the only components in the R-390A that I replace without question are the brown tubular caps. Some folks replace all the tubulars and swear by it, but in my opinion the metal cased, glass sealed units are some of the best caps ever made. In all the ones I've tested, I've only found a couple that had any leakage. The new mylars may well be better, but mercy they do melt fast if you brush your soldering iron against them! The old caps often have a sleeve (plastic or cardboard) which can look pretty grotty, but this doesn't mean the cap is bad.

Date: Fri, 08 Jan 1999 01:39:56 -0600
From: "Dr. Gerald N. Johnson, P.E." <geraldj@ames.net>
Subject: Re: [R-390] Orange Drops et al

The penchant for Orange Drops is that they have been around nearly as long as the R-390 but have worked well the whole time.

In audio circuits, yes the termination of the foil, whether extended foil or tabbed makes little difference, but in the IF stages, the tabbed terminations tend to be series resonant near the IF frequency and so have a little lower reactance than their value would indicate. Extended foil won't have that resonance. The Orange Drops are metallized film, plus paper.

I have Orange Drops that have been through the wash and now are 40 years old and still not leaky by my tough leakage test. I can't measure their leakage its so low yet everything else of the similar vintage leaks like its a resistor.

Date: Fri, 08 Jan 1999 18:54:08 +0100
From: Kurt Schmid <kschmid@mainz-online.de>
Subject: [R-390] capacitor data

After reading the msg. of John Harvie (Wed, 06 Jan 1999 23:46:07) I have started a recapping project with the following goal in mind. All

tubular metal can paper capacitors (Vitamin Q and colleagues) should be refreshed by removing the old stuff inside followed by a refill of the thereafter empty can with a modern capacitor. Thus, not only the electrical data but also the size of the capacitor was of major concern. Compared were data of axial (tubular) metallized film capacitors (no foil capacitors) with three different dielectrics.

Electrical and mechanical parameters:

Pulse Rise Time DU/dt [DV/µs]
Insulation Resistance R [GOhm]
Dissipation Factor tan delta (at 1000 Hz)
Diameter [mm]
Length [mm]

Dielectric material:

PP: Polypropylene
PE: Polyester
PC: Polycarbonate

Considered were the three most common values found in the R-390/R-390A: 0.010 µF, 0.033 µF and 0.1 µF. The selected voltage was 400 V=. Related products of two manufacturers were compared to get an idea about possible differences between capacitor data:

IL: Illinois Capacitor http://www.illcap.com/capacitors/
RO: Roederstein/Vishay http://www.vishay.com/products/capacitors.html

Capacitor series designation:

Illinois Capacitors vs Roederstein/Vishay <snip>
- ---
Date: Fri, 8 Jan 1999 12:03:46 -0600
From: "Craig L. Anderson" <w9cla@spacestar.net>
Subject: [R-390] "Yellow" axial lead metalized film sources

For those of you who asked, there are several sources for the tubular "yellow" metal film caps that I use. I buy in large quantities (1,000 pcs) because I do a lot of Antique Radio restoration. Bob's Antique Radios and Electronics in LaGrange, IL is a good source. He buys in large quantities direct from the manufacturer. He sells in 25 piece lots only but as an example, his 630 volt metal film axial lead caps at .01ufd sell for $6.50 for 25 pieces shipped!

He has a website but I don't remember the URL. His fax is (708) 352-

0647 and telephone is (708) 352-0648. He is prompt and stocks a lot of caps. Antique Electronics in Phoenix also sells them but their unit cost is about 2X higher and you pay shipping and there is a $10.00 minimum order.

Date: Fri, 8 Jan 1999 21:39:18 -0500 (EST)
From: Norman Ryan <nryan@duke.edu>
Subject: Re: [R-390] "Yellow" axial lead metalized film sources

Bob's e-mail is: radiobob1@aol.com

I found a website (not his) that describes Bob's offerings together with prices on tubulars and electrolytics. Sounds like a good deal if you order in lots of 25. URL: http://members.aol.com/oldradio99/bob.html

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Date: Sat, 9 Jan 1999 14:00:37 -0000
From: "Chuck Rippel" <crippel@erols.com>
Subject: [R-390] Re: Source of Orange Drops rated @ 1500 V=?

Goodness-gracious, for what practical reason? The .01 at 1600V that I got from Antique Radio is 1/2 the size of a 5749 tube for crying out loud. The one place you MIGHT MAYBE use that kind of cap is at C-553 and it won't come close to fitting without long, RF leaking lead lengths.

600V Orange Drops are >more< than adequate. Remember, save for a very few, the stages in the R390A are NOT capacitor coupled and thus DO NOT have B+ on one side and the grid of a tube on the other a-la 75A-1, 75A-3, 75A-4, etc..... The radio is largely TRANSFORMER coupled. The majority of the caps the '390 that are easily and practically replacable are simple bypass capacitors.

Date: Sat, 09 Jan 1999 11:57:34 -0600
From: "Dr. Gerald N. Johnson, P.E." <geraldj@ames.net>
Subject: Re: [R-390] Source of Orange Drops rated @ 1500 V=?

Actually all the Orange Drops I've tested seemed to have a lot of excess voltage rating because they leak zero at rated voltage. And my samples have stayed that good for more than 30 years.

I say leak zero, with some caution, my test doesn't reach absolutely zero as sensitivity, but gets close enough.

My most sensitive test, I use a VTVM on the 1.5 volt scale as my current indicator. Passing is less than half a volt across 11 megohms. That's 45 nano amps. My power supply isn't stable enough for being pickier. Orange Drops do better than that criteria. The VTVM bobbles about as the line

voltage changes feeding the power supply.

The place most critical for leakage in nearly every radio is the coupling capacitor from the first audio plate to the output tube grid. The output tube grid resistor is nearly always half a megohm, so each microamp of leakage current reduces the bias by half a volt. In American output tubes, grid bias on that stage tends to be in the range of 4 to 8 volts (European output tubes tend to use a lot greater grid bias, so leakage wouldn't be as touchy) so half a volt change starts to be serious. More typically a leaky coupling capacitor will get more and more leaky with time leading to damage to the output tube, and maybe the output transformer. When tube and/or transformer are far more expensive than the coupling capacitor its of long term benefit to use a very low leakage coupling capacitor with a proven long term reliability.

As for high voltage OD's look for the OD's rated for being connected across the AC line they have particularly tough leakage specifications because they are intended for circuits where people can be a part of the circuit (chassis to earth when the chassis isn't grounded).

Date: Mon, 11 Jan 1999 12:27:39 -0400
From: "Chuck Rippel" <crippel@erols.com>
Subject: Re: [R-390] AF Deck question...

This is common; you have a cap leaking biasing off a circuit. First off, replace C-553 and C-549 in the IF deck. Second, replace all the plate-grid coupling caps in the AF deck. Look at the print. The circuit configuration you are seeking "looks like" C-605 off the plate of V-602A or C-604 on the grid. Failing that, I should rebuild your filter caps. Look at the cathode of V-601 A/B and you can see why the new (NOT NOS) caps have such a drastic effect on the R390A audio.

From: Nolan Lee <nlee@gs.verio.net>
Subject: [R-390] C-275 value error in manuals...

>I decided to replace the brown tubular caps in my Stewart Warner RF deck
while I had it out for refurb.

Cheap insurance. Just for kicks, did you check the old ones that you removed? Cracked? Leaky?

>C-275 looks like it is a .033 mfd cap, from the part removed (color code I >think is Or-Or-Or ?), and from Nolan Lee's 'Cap List' (thank you Nolan!). >But my Army TM Maintenance manual calls for a .0033 (3,300 for MOD 1

>and 2 units) or .005 (5,000 and for early units) in at least four places.

I just pulled four original unmodified spare RF decks to verify the value of C275. In the two Collins decks, C275 is a "brown beauty of death" colored coded as follows: Orange Orange Orange Black Orange This translates out to 33,000 mmfd with a 300 volt rating. I just dug thru a can of capacitors that I've removed when replacing the caps in various modules and tested one marked as above. It tested out at about 40,000 mmfd or 0.04 mfd.....

In a pair of spare '67 EAC decks, they used those yellow Aerovox oval capacitors marked as follows for C275 .033 mfd +- 20% 400 volts. They retained the same capacitance but increased the voltage rating by a hundred volts. I've been using 400 volt rated 715P series Orange Drops as replacements for this value every where in the R390A.

>Additionally, the TM photo shows a pretty small cap (not a 'brown beauty').

Yes, the pictures in both my 1956 and old 1961 manuals show what looks like the bottom view of a ceramic disk capacitor as C275. I don't have the 1970 Navy manual handy, but it probably uses the same pictures. I think that the 1970 Navy manual parts listings has the value of this cap as .033, so they might have finally caught the typo. I used it as a basis for the capacitor list.

>Which is correct (perhaps all?)? I have new caps on hand for the .0033, but
>not .033. If it is .033, has anyone substituted a .047 or .022 for it?

The correct value for C275 is .033 mfd. The Army TM* manuals are wrong. I just checked the latest edition I have, of TM-11-5820-358-35 with C4 dated 1/88, and it still lists the incorrect value. ;-(

Do any of you guys have any of the loose change sheets later than C4 for this manual? If so, I'd like to get a copy of them. Personally, I don't think that I'd substitute a different value for it, I'd use the .033. Figuring that when they determined that the original design value wasn't optimal, there was probably a pretty good reason that they chose .033 as the value for the modification. Maybe it was just because that value was already used in the receiver and the spare parts issue wouldn't change. You never know though. I ain't no engineer, just a redneck. <grin>

Date: Mon, 08 Mar 1999 09:47:09 -0700
From: "Eustaquio, Cal J" <cal.j.eustaquio@lmco.com>
Subject: [R-390] "black cat" caps?

I hate to beat on a dead horse again but I would like to know about these particular caps as opposed to the black beauties we've been discussing for some time. These are fairly large sized caps that say "Black Cat" in white print. Discovered some fairly large ones in my SW-3 (been recapped). They don't resemble the "black beauties" at all but look more modern and well made. Just want to know. It may be slightly off topic but since we've been down this road a bit, I'd like to solicit some opinions. Tnx. Cal.

Date: Mon, 08 Mar 1999 12:17:51 -0600
From: "Dr. Gerald N. Johnson, P.E." <geraldj@ames.net>
Subject: Re: [R-390] "black cat" caps?

Take them out and test them by my leakage test criteria (less than 1 volt on a 11 megohm VTVM with rated voltage applied to the capacitor in series with the VTVM) and report back.

Date: Mon, 8 Mar 1999 20:18:25 -0500 (EST)
From: Norman Ryan <nryan@duke.edu>
Subject: Re: [R-390] Capacitors

Your caution sounds commendable. These receivers are veterans and will fade away like the proverbial old soldiers. To defer that unhappy day, we should take extra steps to prolong their useful life. <snip> The metal and glass sealed caps (Westcaps, etc.) are generally reliable, but you definitely should replace C549 and C553 B+ blocking caps with 600 Volt Orange Drops. As for the other paper caps (yellow drippy waxy Aerovox and brown beasties, etc,), you're better off replacing them with modern caps. Nolan posted a list of the paper caps a while ago and I think it is on one of the FAQ sites by now.

Silver micas and ceramics need to be replaced as needed. If alignment doesn't go right, silver micas in the RF deck are suspect. If you have the set apart already, go after them.

Antenna relay probably just needs cleaning. Disconnect the wires to the solenoid, remove the unit and have a go at cleaning and adjusting it. It takes only a little grunge to cause the armatures to go out of adjustment. Watch out you don't lose the little Nylon pins that will drop out when you take the relay apart.

Have fun. If that's not enough to keep you entertained, measure the carbon comp resistors. On average you'll find about 25% of them have increased over 10% in resistance! :-)

Date: Tue, 09 Mar 1999 10:38:37 -0600
From: "Dr. Gerald N. Johnson, P.E." <geraldj@ames.net>

Subject: Re: [R-390] SBE/Orange drop

> It seems to be the opinion that the yellow Aerovox need to go.
> Antique Electronic Supply sells 600v polypropylene SBE which
> are quite large for both the IF and audio decks. Is there an
> independent supplier of the SBE 400v polypropylene?

Mouser (www.mouser.com 800-346-6873) has Orange Drops in 200, 400, 600, 800, 1200, and 1600 volt ratings.

> What would the resulting behavior ... if the various yellow Aerovox connected to the IF tubes (acting as a bias capacitor, I think) shifted in value or started to leak?.....

Depends on the capacitor. The paper capacitors are used for AGC bypass, screen bypass and plate supply bypass and the occasional coupling capacitor mechanical filter input). Shifting in value is not a normal failure mode, becoming leaky is the common failure mode. Leaking on the AGC line will prevent AGC from working, and lead to distortion in the later IF stages from them being over driven. Leaking screen grid bypasses will cause low IF stage gain and a tendency for the screen dropping resistor to release smoke and shift in value. Leaking plate supply bypasses will cause low IF stage gain, and low output then clipping distortion and smoking or overload of the plate circuit isolating resistor. Each of these conditions can be traced with voltage checks, but since the oiled paper capacitors of the original era have proven to often to fail, its far easier to replace them all the first time you have the module removed from the radio than the wait for each one to fail and take other parts with it. If the leakage current of the mechanical filter coupling capacitor gets excessive it may cause a mechanical filter to burn open.

Date: Fri, 12 Mar 1999 17:16:38 -0500
From: Dennis McLaughlin <dennism2@ix.netcom.com>
Subject: RE: [R-390] SBE/Orange drop

I used the Panasonic polypropylene film caps from DigiKey.part numbers

P3476-ND 0.01 @ 400V
P3482-ND 0.033 @ 400V
P3488-ND 0.1 @ 400V

All fit well on the IF deck. They will not fit on the audio deck. I used the tubular metalized polyester caps from Antique Electronic Supply parts

CT-.01-400
CT-.022-400
CT-.033-400

Date: Tue, 30 Mar 1999 09:00:00 -0600
From: Gary Maples <misheb@execpc.com>
Subject: [R-390] Sangamo Caps in R-390A

Nolan's posting of the R-390A cap list about three weeks ago motivated me to begin the re-capping process on my two R-390A's. Of course, C553 ("The Cap of Death") was first to go and the brown beauties are following. BUT, he says, what about the small grey/silver Sangamo caps? As long as things are apart, I'm going to replace them. However, there has never been much discussion about their quality. Black and brown beauties are scorned and abused appropriately, but does anyone have solid info on the Sangamo cap performance? They look (outward appearance) to be well built and sealed. Inquiring minds want to know.

Date: Tue, 30 Mar 1999 09:34:08 -0600
From: "Dr. Gerald N. Johnson, P.E." <geraldj@ames.net>
Subject: Re: [R-390] Sangamo Caps in R-390A

Those you will need to test with power supply and VTVM as I've described several times.

Date: Tue, 30 Mar 1999 11:50:19 -0400
From: laffitte@prtc.net (laffitte)
Subject: [Fwd: [R-390] Sangamo Caps in R-390A]

Like the Vit. Q gray sealed caps, the Sangamo caps are probably of good quality but in a replacement job like this I would go ahead and replace them too. There are even some mica caps that are failing too and have changed values. My experience with the RF deck in the Stewart warner was that replacing all of the mica plate coupling caps was a major factor in restoring sensitivity.

Date: Tue, 30 Mar 1999 10:46:38 -0600
From: "A. B. Bonds" <ab@vuse.vanderbilt.edu>
Subject: Re: [R-390] Sangamo Caps (& others)in R-390A

Well, there are others on the "How about it?" list as well. My Capehart has a lot of yellow film caps. I am disinclined to replace them, 'cuz I generally replace with... yellow film caps. Any reported failures? And I have never run across a sealed (metal can/porcelain ends) cap, like a Vitamin Q, that has leaked in the least, but I'm willing to learn. A good item of intelligence for the FAQ/CD-ROM.....

Date: Wed, 31 Mar 1999 05:22:17 -0600
From: Nolan Lee <nlee@gs.verio.net>

Subject: Re: [R-390] Sangamo Caps (& others)in R-390A

Yellow film caps that are 30+ years newer and probably made with better plastics than were available 30 years ago. <grin>

>Any reported failures? Yes, both Aerovox and West-Cap. ;-)

>I have never run across a sealed (metal can/porcelain ends) cap, like a >Vitamin Q, that has leaked in the least, but I'm willing to learn.

They fail too, Both by electrically leaking and physically leaking oil. They seem to have a lot better track record than the molded or wrapped caps though.

Date: Wed, 31 Mar 1999 04:51:16 -0600
From: Nolan Lee <nlee@gs.verio.net>
Subject: Re: [R-390] Sangamo Caps in R-390A

>BUT, he says, what about the small gray/silver Sangamo caps?

The metal and glass sealed capacitors were a much higher and more expensive grade of capacitor, and seem to have held up better thru the years than the brown tubular and yellow wrapped caps. I don't remember the exact ratios of good verses evil ones that I found when I tested them, but it wasn't anywhere near what the ratios were for the tubular and wrapped capacitors.

>As long as things are apart, I'm going to replace them.

I received a lot of interesting pro and con e-mail when I announced that I was in the process of replacing all of under chassis paper caps in the '67 EAC last year. The major question was "why?". Over the last 23 years of screwing around with R390A's, the greater majority of the "gotta dig out the soldering iron to fix" failures that I've had were capacitor related. Zap! There goes a cap, it takes a choke and a resistor with it and creates a little mushroom cloud. Zap! There goes another cap, that one takes a couple of resistors and a tube. Hmmm, the AGC isn't working right. After digging around for a while, yep, another capacitor. It's not like this is a daily occurrence, but over the years it gets old pretty quick.

My original intent was to go thru the EAC and when finished, have a receiver that would hopefully run "just this side of forever" and need only tube and dial lamp replacements and an occasional alignment and lube job. I've even tried to cut those maintenance requirements by using synthetic lube and 20K or 30K+ hour dial lamps. <grin> It's been running

24/7 since about the second week of October of last year. When I get a chance, I want to pull it out of the rack and check the tubes and alignment. I do need to tweak the carrier meter
adjustment. ;-)

I look at the cost of the capacitors and my time to replace them as "insurance". Think of it this way, if I offered you two dollars to troubleshot and pull the RF deck out of your radio, you'd probably either tell to go to hell or flip me off. But, for two dollars and a little extra time while you have the RF deck out for cleaning or a repair, you can replace the three tubular capacitors under it and pretty much eliminate having any problems with them for the duration. Ditto for the audio deck, at a slightly higher cost. Both of these modules are very simple to recap. I can't say the same for the IF deck. If you're going to follow the original parts layout and do a really nice job, it's very time consuming.

>However, there has never been much discussion about their quality. Black >and brown beauties are scorned and abused appropriately, but does anyone >have solid info on the Sangamo cap performance? They look (outwardly >appearance) to be well built and sealed. Inquiring minds want to know.

They were a good quality capacitor but remember, they're thirty or forty years old. If they test good now, will they still test good next month or next year? What about five or ten years from now when they're 50 years old? I don't know about you, but I have no plans to sell either of mine and would love to still be using them thirty of forty years from now. While you're in there and have the module out, spend a few dollars and replace them with a good quality capacitor. Then, you can forget about them. :-) I don't remember the exact numbers, but for me to replace all of the paper caps in the IF deck with 400 and 600 volt Orange Drops was probably about fifteen dollars. I don't think that it'd cost much more than twenty dollars or so do the entire receiver. Cheap insurance... Oh, I found it a lot easier to recap the IF decks by removing the VFO and bellows coupling and the bandswitch shaft. Your mileage may vary. <grin> While you're in there, don't forget to measure the values of all of the carbon composition resistors and change any that are either out of tolerance or, if you're as paranoid as I am, any that are close to being out of tolerance.

Date: Fri, 02 Apr 1999 17:21:54 -0600
From: Nolan Lee <nlee@gs.verio.net>
Subject: [R-390] R-390A Master Capacitor List BETA

I had about 7 hours of free time today and I knocked out a beta of the following capacitor list that I've been wanting to finish for a while. It contains listings for ALL of the capacitors in the R-390A receiver. I'm missing a few fields on a small number of them. If you have the missing

information, I'd appreciate it if you'd forward it to me and I'll update the list. This is a BETA, so it's possible that there's a few errors that need to be chased down. If you spot an error, drop me a note and I'll fix it. Please don't forward the entire list to me. :-) (see revised list later in archives.....)

Date: Fri, 2 Apr 1999 23:58:36 -0600 (CST)
From: Bill Hawkins <bill@iaxs.net>
Subject: Re: [Fwd: [R-390] R-390A Master Capacitor List BETA]

It was indeed a great job. Many thanks. I have had several PTO's apart. The capacitors in them are not the kind you can buy at Mouser. The only way to replace one is with a good cap from another PTO. At least, if you want to retain the low drift characteristic don't put in a commercial part. But it seems that caps built for low drift are also pretty reliable.

Date: Sat, 03 Apr 1999 00:21:04 -0600
From: Nolan Lee <nlee@gs.verio.net>
Subject: Re: [Fwd: [R-390] R-390A Master Capacitor List BETA]

It's been a while since I had one apart. I don't remember if they were dogbones or another style of ceramic caps with special temp. characteristics. You won't get them from Mouser, but they're probably available on the surplus market.

>The only way to replace one is with a good cap from another PTO. At least, if >you want to >retain the low drift characteristic don't put in a commercial part. But it seems that caps built >for low drift are also pretty reliable.

Yep. It'd still be nice to be able to list their values and characteristics. Keep me in mind the next time you have a reason to pull a PTO apart.

Date: Sat, 03 Apr 1999 09:12:00 -0600
From: "A.B. Bonds" <ab@vuse.vanderbilt.edu>
Subject: Re: [Fwd: [R-390] R-390A Master Capacitor List BETA]

I'm not convinced of that. You can get NPO ceramics from Mouser, and they seem pretty stable to me...

Date: Sat, 3 Apr 1999 10:30:19 -0600 (CST)
From: Bill Hawkins <bill@iaxs.net>
Subject: Re: [Fwd: [R-390] R-390A Master Capacitor List BETA]

Yes, you can get NPO's from Mouser. Not at all sure that's what was used, though. The big cap is a 1% part. Hanging from the bus wire that attaches the cap to the coil are two flat, grayish, ceramic-looking plates about 1/2 inch wide and 1 inch long. Their temperarture compensation

characteristics could be anything. If the PTO works, I don't feel the slightest desire to replace them with modern components.

Date: Sat, 03 Apr 1999 11:28:03 -0600
From: "Dr. Gerald N. Johnson, P.E." <geraldj@ames.net>
Subject: Re: [Fwd: [R-390] R-390A Master Capacitor List BETA]

The flat open capacitors in a PTO were chosen for temperature compensation. Ordinary NPO caps won't do well there. I've said it before and I say it again! NPO caps aren't as stable with temperature or as predictable as N075 and other temperature compensating capacitors. Look up a catalog on them. Yes such catalogs are still available, though they may be dusty... Both the value and the temperature coefficient were chosen for a particular PTO. I used to (long ago) see such capacitors by the box at Collins Surplus. Guess I should have bought a thousand to keep until today and auction on e-bay... individually. There are capacitors used for bypasses around the oscillator tube that in some PTOs have a tendency to fail. They were marginal in voltage rating to fit in a small space. Something like .001 or .002 at 200 volts paper. Need to be replaced with dog bone ceramic or Orange Drops to fit in the space. 73, Jerry, KOCQ

Date: Sat, 22 May 1999 12:37:32 -0500
From: Nolan Lee <nlee@gs.verio.net>
Subject: [R-390] Capacitor Problems in R390A...

>I'm going to cross-post my reply to you to the list where it might be of use to >others.

For the 0.1 and 0.033 values, I use 400VDC ones. For the 0.01 values, I use 600VDC ones. The reason that I don't use 600VDC ones everywhere is that they tend to get rather large in the 0.1 and 0.033 values.

>From the list, it appears the 0.1's are 100WVDC and the 0.033's are 300WVDC. I find 0.1uf @ >200VDC and 0.033uf @ 400VDC (both type 715P Orange Drops) in the Mouser catalog. Would >these be the correct substitutes or should I go for 400VDC on all of them?

There are several ways to look at it. The first is to use caps that approximate the original ratings like the little yellow axial lead caps that AES sells. They're less expensive, smaller, a hell of a lot easier to install, and will probably out last a long time. The second, which is the way I did mine, is to use caps of a higher quality (OD's or CDE's) and a higher voltage rating as "insurance". The cost difference between the 200 volt capacitors and the 400 and 600 volt capacitors isn't that much. They're a little harder to shape the leads on to mount in the IF deck. But, you decrease the odds of having to spend time at a later date trouble shooting

some oddball problem in say, the AGC circuit because of a slightly leaky cap. It's worth the extra effort and extra few nickels in my opinion to greatly decrease the odds of this, and increase the overall reliability of the receiver.

>I'm concerned about being able to fit the slightly larger 0.1's in some of the tighter places.

There are only a couple of places that you'll have to spend a little extra effort, mainly on the IF deck. I can tell you from firsthand experience that the following three capacitors can be used as replacements in the R390A in every location for those specific values. You'll have to spend a little extra time and shape the leads. Always try to duplicate the original layout if you can, especially in the IF deck. It's a pain in the ass, but it can be done. Count on spending a few evenings to do the IF deck if you do it right. You'll probably find a few out of spec resistors that you'll need to change too.

```
715P        .01  600VDC
       .033 400VDC
       .1   400VDC
```

I have no plan to ever get rid of either of the two R390A's that I currently have. I've had one of them since 1975, it was my "first". As a result, I don't have a problem with going the extra mile to decrease the chance of a problem ten or twenty years from now. Since 1975, almost every major "melt down" that I've experienced in the number of R-390A's that I've owned has been linked to the failure of one of the original paper capacitors. When they go, they take other stuff with them, resistors, inductors, tubes, mechanical filters, etc. I don't know which mfg. or vintage of your receiver or modules are. There were three basic types of axial lead paper caps used in them. The brown beauties of death, the yellow wrapped "Aerovox" style, and the metal/glass sealed "Vitamin-Q" type. I make it a habit to check the values and leakage of ALL replacement caps and all of the old ones that I remove. From the ones that I've replaced, almost all of the brown beauties of death are leaky, followed by "some" of the yellow ones, followed by a "few" of the metal/glass ones. I say, change them all while you're in there.

There are three of the axial leaded paper capacitors on the underside of the RF deck, usually either BB's of death or the yellow wrapped ones. Change all three of them while you have the RF deck out. It's not worth the trouble to have to pull the RF deck some where down the line because of a sixty cent capacitor that you didn't replace. While you have the radio apart, make sure that you check the values of the resistors and change any that are out of spec.

On the RF deck, check the stud mounted, above chassis capacitor near the 6DC6 tube. I found one bad recently. Also, clean the wafers and contacts of the bandswitch. If there's any oil or film on the switch wafers, they're prone to flashover to the shaft resulting in a ruined wafer. The fiberglass wafers seem more prone to this.

While you have the AF deck out, change the little acid leaking wet tantalum with a new one. I think that it was Sprague 150D's that I used.

Oh, changing the caps in the IF deck is a lot easier if you tag the three leads to the BFO and remove it and the bellows. Also, loosen and slide the bandswitch shaft out of the back of the module. Also, watch out for the little standoff insulators that some of the caps are attached to. They're easy to break, and don't like much heat either. Don't forget to check the 2mfd above chassis mounted cap on the IF deck while you have it out. I found two leaky ones last year. Hope this helps,
nolan

Date: Thu, 3 Jun 1999 15:33:10 -0400
From: "Chuck Rippel" <crippel@erols.com>
Subject: [R-390] Failure for the Books !

Worked on an R390A and found the condition below. I'd save it to the archives as it could lead one on a merry chase. Those of you who have the radios, plan on replacing this cap during your next maintainence. It has made my list of caps I will always be replacing. Its easy to get to and not worth the trouble of having it go bad. I have added this information to the Technical Section of the WWW site. For those who haven't been there in a while, I gave it a bit of a face lift the morning of Wednesday, 6/2.

The failure symptom is low, distorted audio which improves when the LIMITER control is turned on and advanced to "1" or "2" on the dial.

This condition is caused by the failure of C-536, a 0.1ufd 200V plate bypass capacitor for the limiter tube, V-507A and V-507B. Meausuring the plate voltage at pins #1 and #6 reveals little or no voltage instead of the normal 73V. Replacing C-536 with a 600V Orangedrop type corrects the problem.

Date: Thu, 03 Jun 1999 14:18:31 -0500
From: "Dr. Gerald N. Johnson, P.E." <geraldj@ames.net>
Subject: Re: [R-390] Failure for the Books !

I still maintain that for a radio of that age, that if its a paper capacitor, and not mylar, polyester, ceramic, or mica, that its less work to replace it

without testing than to trouble shoot every blasted bad capacitor because most have gone bad. Same thing but at 1/4 the age for electrolytics. Just replace the paper and electrolytics throughout the radio and spend your time listening instead of trouble shooting.

Date: Tue, 20 Jul 1999 18:58:44 -0400
From: brumac@juno.com
Subject: [none]

I am recapping my 390As with the Orange Drops that have been recommended on this reflector in the past, but what about the ceramics and postage stamp micas and where can I buy properly rated ones? I am assuming that I should use 1000v NPO ceramics, but they seem to be hard to find. One private contact suggested that they are quite reliable and that I may do more physical damage by replacing them, but I found one to be extremly leaky in a '63 Capehart IF module, frying a resistor and a choke, so I'm a little paranoid about them. What is the general thoughts of a 100% cap replacement or just a paper and electrolytic swap-out?

Date: Tue, 20 Jul 1999 17:58:36 -0500
From: "Dr. Gerald N. Johnson, P.E." <geraldj@ames.net>
Subject: [R-390] Re:

Fix micas and ceramics as needed, not a shot gun approach. They should tend to have short leads that might be a little critical for good 30 mhz operations in the RF section. They don't fail nearly as often as paper and electrolytics.

Date: Wed, 21 Jul 1999 00:40:11 -0400 (EDT)
From: Norman Ryan <nryan@duke.edu>
Subject: [R-390] Re: your mail

Replacing the paper caps is a good idea, especially if you have the "brown beauties." The glass sealed ones, however, are generally good although Orange Drops will surpass them.

In any case, and without fail, replace the two blocking caps C549 and C553 with 0.01 Mfd, 600 Volt Orange Drops.

Better to leave the ceramics and micas alone except where you encounter a failure. The work involved in replacing them far outweighs the chance you'll find another defective unit. Mouser is a good source for replacements when needed.

Another cap to look at is the wet tantalum C609. If it shows corrosion, replace it with an 8 Mfd, 30 Volt or better, unit such as the Sprague series

150D.

Consider rebuilding the plug-in filter caps C603 and C606 if the bases show corrosion or leakage. That should keep you busy for a while. :-)

Date: Tue, 20 Jul 1999 23:51:02 -0500
From: Nolan Lee <nlee@gs.verio.net>
Subject: [R-390] ceramic and mica cap replacement...

At 06:58 PM 7/20/99 -0400, you wrote:

> I am recapping my 390As with the Orange Drops that have been recommended on this >reflector in the past, but what about the ceramics and postage stamp micas and where can I >buy properly rated ones?

It's very rare for one of the 5000pf (.005mf) ceramic disc capacitors in the R-390A to fail. I can remember only seeing one in recent times, and it had cracked physically. Even this doesn't mean that it's "bad" but I'd replace any cracked or physically damaged ones anyway. I've seen ceramic disc capacitors have their values "trimmed" to a specific value with precision saw cuts and they work fine. CD's are pretty durable and the ones in the R-390A are all rated at almost four times the maximum DC voltage of the receiver. Personally, I wouldn't just arbitrarily replace all of the ceramic discs in the receiver.

I clipped a bunch of the CD's out of a St.Julians RF deck that had sat out in the weather long enough for the bleached out looking resistor and molded choke color code bands to start falling off and all of CD's that I tested, were perfect at 800 volts DC. I would have ran them up to 1300 volts but the other PS was 'under the weather" at the time. I suspect that they'd have performed just as well at their rated voltage of 1KV.

I'm able to test a good number of the ceramic capacitors in circuit in my receivers without having to remove them. Depending on the equipment that you have on hand, you might have to unsolder one leg to test them. If you have the equipment to test the greater majority of them in circuit, by all means, do it while you have it apart.

The mica capacitors are another story. I've found a number of them leaky on the RF deck in some of the various coil cans. I've also corresponded with others that have had some tough to find problems that turned out to be leaky mica caps in the R390A. I wouldn't run out and replace all of the mica capacitors since they're generally very reliable, but I would test all of them that I could. Pay particular attention to the two ~1500pf ones in the two Z201 (.5 to 1 MHz) coil cans. About half of the ones I've tested have been leaky. The tolerance of the values of most or all of the mica caps in

those cans are 2%. I've seen the actual value of a lot of them down to 1pf hand inked on the edge of the capacitor. I've got a leaky one marked 1499 pf sitting here now. Since the parts list specifies 2% and someone went to the trouble to actually measure the precise value of them before the cans were assembled, if you do have to replace any of these, you should really put forth the effort to stay within the 2% tolerance range. Finding them will probably not be easy or cheap.

Before you go thru the trouble to check those caps, you might want to search back thru the list archives. I made a couple of posts on things to look for and ways to correct various problems with the RF deck "canned" coils. Try using the following key words, in addition to "nolan" : leakage coil dope variable mica

If you can't find it, holler back and I'll dig through my archives and repost it.

>I am assuming that I should use 1000v NPO ceramics, but they seem to be hard >to find.

I think that Mouser Electronics has 5% 4700 pf ones which are within the original 15% tolerance specified for the 5000 pf ones.

>One private contact suggested that they are quite reliable and that I may do >more physical damage by replacing them,

It depends on your soldering methods. Before you start replacing any under chassis components in the receiver, make yourself some "soldering shields" out of some soft .008 or .010 shim stock. If you don't have any shim stock, cut them from a drink or beer can. Cut an assortment of different width metal strips about two inches long. I generally use an assortment of widths from about 3/8 of an inch to 2 inches, depending on the application. You can always keep an empty can and a pair of snips handy to make odd sizes as needed. These are flexible and can be wedged around, under, over, etc. the area that you're soldering and will add insurance against damage to other stuff from "slips" of the soldering iron. Cheap and they work. Naturally, you don't want to deliberately place the soldering iron against them. ;-)

>but I found one to be extremely leaky in a '63 Capehart IF module, frying a resistor and a choke, so I'm a little paranoid about them.

You had electrically leaky ceramic disc capacitors in an R390A? Interesting. I've seen a lot of leaky paper caps fry resistors and chokes in the IF decks, but never a CD. Which specific components were fried? Were any of them located on circuit board TB501?

>What is the general thoughts of a 100% cap replacement or just a
>paper and electrolytic swap-out?

A hell of a lot of work. And, unless your receiver was assembled with a "bad lot" of CD's, subjected to some abnormal environmental conditions like a gravity well, black hole, gamma rays, rap music, etc., or just simply had the gris gris (a curse to you Yankees, pronounced gree gree) put on it, probably not needed. :-)

Replacing C-549 and C-553

Page prepared by: Chuck Rippel Rev: 01 September 23, 1998

Imagine turning your receiver on one day and nothing comes out of the speaker. after checking the connections, you select another bandwidth filter. The receiver comes alive for about 5 seconds then goes dead again. Selecting another filter causes the same result. What could be wrong? You have just experienced a failure of C-553, the blocking capacitor located between the plate of V-501 and the mechanical filters. Unfortunately, all of the mechanical filters that were selected are now also ruined and must be replaced. That is best avoided by a simple procedure to replace the C-553 which is originally a 300V Sprague "Vitamin Q" capacitor. Besides the capacitor simply being old, todays increased line voltages in turn cause an increase in receiver B+ values that run this capacitor even closer to failure.

Replacing the capacitor is easy. It is located in the IF deck and is easily accessible.

To remove the IF deck:

•Loosen the clamps with a bristol spline wrench on the Bandwidth and BFO Pitch controls. Note the position of the BFO indicator so you can align the shaft to its original position. Also, be careful not to move that portion of the BFO shaft where it enters the IF deck.

•Remove the 3 cables at the rear of the IF deck, P213, P218 and P114.

•Unplug the large multi-connector, P112

•Loosen the 3 green headed captive screws holding the IF deck into the main chassis and lift it clear to an uncluttered work space.

•Looking at the bottom of the IF deck, locate C-553. Its location will appear like this; <snip>

•Remove the old C-553 and install a .01ufd, 600V Sprague Orangedrop capacitor in its place. Try and nest it vertically in the chassis as original. Because B+ is involved, be sure to use shrink tubing fully covering any exposed leads on the new capacitor.

•While the deck is out, its a good idea to also replace C-549. This is a blocking capacitor for the output of the limiter, V-507A. Leakage here will change the bias on the grid of the first audio amplfier, V601A causing low audio levels, distortion or complete audio shutdown. Again, replacement with a .01uf 600V Orangedrop is the solution.

Date: Mon, 02 Aug 1999 09:22:11 -0500
From: "A. B. Bonds" <ab@vuse.vanderbilt.edu>
Subject: Re: [R-390] R-390 rebuild

I don't think Black Beauty caps are NPO. That being said, not all 390A's have Black (or Brown) Beauties. These caps are easily recognized by having cylindrical plastic shells that are...black or brown. They often have color stripes on them just like a resistor. If you find such caps, you may assume that they are bad. Other caps, such as the Vitamin Q type (metal case with porcelain seals) or film type (usually yellow) are rather more reliable, though one cannot assume that they are good. R-390 parts are becoming quite scarce. You might check with Dave Medley about rebuilding your deck, he is probably the most experienced with 390s.

Date: Wed, 04 Aug 1999 18:42:00 -0500
From: Nolan Lee <nlee@gs.verio.net>
Subject: [R-390] Resistance Values of Capacitors...

I've had a lot of inquiries as to the resistance values that I use for rejection of capacitors when I use an ohm meter to test them. Well, while digging thru some boxes of manuals earlier this week looking for some RTTY manuals, I found something by Solar that I had forgotten about. It's a manual for their old model CF capacitor tester dated November of 1946 and was the source of those values. What better source of capacitor information than from a capacitor manufacturer?

3.3 Insulation Resistance <snip to remove non-capacitor related information>

3.3.3 Supplementary Information. An insulation resistance (I-R) of 50 megohms at the operating temperature of the equipment will be found satisfactory for most circuit applications. Coupling capacitors should have an I-R in excess of 200 megohms. Replacements should be made as indicated.

3.3.3a New mica capacitors will have an insulation resistance greater than 3000 megohms for RMA "A" classification units, and greater than 6000 megohms for other RMA classifications. New ceramic capacitors will also meet the 6000 megohm value. New halowax or mineral oil impregnated, wax-filled or wax-molded paper tubular capacitors will usually meet the limits imposed by the Radio Manufacturers Association. These call for a minimum insulation resistance-capacitance product of 1000 megohm-microfarads or a maximum required insulation resistance of 5000 megohms, whichever is the smaller. For commercial, oil-impregnated, oil-filled capacitors in metal cases, trade limits are generally as follows:

Oil	Minimum RxC	or	Max.Req. I-R
Vegetable	400		1200
Mineral	1200		3600
Chlorinated Synthetic	1750		4250

All of these values are for measurements at 25 degees C (77 degrees F). Insulation resistance will decrease very rapidly at temperature increases. At 65 degrees C (149 degrees F), the insulation resistance of an ordinary wax tubular will be about 5 percent of its I-R at 25 degrees C (77 degrees F).

Date: Thu, 5 Aug 1999 08:54:24 -0700 (PDT)
From: W Li <wli@u.washington.edu>
Subject: [R-390] Re: Recap shopping list

I had a chance to go over Nolan's R-390A cap list, and rehacked it to reflect my needs. This is only a working list, so let me know of errors. A shopping list for any recap kit would include:

(13) 0.1 ufd C256, C309, C504, C505, C517, C521, C528, C531, C536, C538, C543, C547,C548,

(7) 0.033 ufd C275, C529, C533, C534, C541, C545, C602

(7) 0.01 ufd C549, C553, C601, C604, C605, C607, C608

(I'd go with the SBE 716P 600v OD's at the outset, seeing as how recapping is not a trivial project)

(3) 30 ufd 300 v electrolytic C603
(2) 47 ufd 300 v electrolytic C606

(Sticking new electrolytics in an empty octal relay case as Tom Norris did, worked out swell for me)

Finally, only one needed of:

0.047 ufd 100v C227
50 ufd 50 v electrolytic C103
0.22 ufd 100v C101
8 ufd 30v tantalum electrolytic C609
2 ufd 500v C551 oil-filled paper

Obviously C553 and C549, and the AF deck electrolytics C603 and C606 take precedence in any recap project, as stressed in earlier posts. Now here is a chance for AES to make up a 37 item kit (just kidding).....Thanks, W. Li

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Date: Thu, 05 Aug 1999 14:42:55 -0400
From: Christian Fandt <cfandt@netsync.net>
Subject: Re: [R-390] Re: Recap shopping list

W Li said something like: I had a chance to go over Nolan's R-390A cap list, and rehacked it to -- snip list --

>2 ufd 500v C551 oil-filled paper

Thanks for the organized listing W. Li! Anyone know where one would get the above capacitor?

Also, as I've been planning to be on the lookout for several 2 uf capacitors to restore several capacitor checkers in my collection, a high accuracy cap would be desired (2% accuracy or better) so I could buy in a small quantity.

Many cap checkers use a 2 uf, 2% paper cap as one of the range capacitors. Anybody know of any such critters?

Date: Thu, 05 Aug 1999 14:57:56 -0500
From: Nolan Lee <nlee@gs.verio.net>
Subject: Re: [R-390] Re: Recap shopping list

I've never been able to find them (2 ufd 500v C-551 oil filled paper cap).

I've got as couple of dead ones here that I plan to open and stuff modern guts in. I'm torn between using a 1.8 mf or a 2.2 mf cap.

I'm looking for a pair of 5% accuracy ones rated at 200VDC for a couple of mine. No luck as of yet. If you've got access to a really good lab grade GR or similar C bridge, pickup a 1.8 mf orange drop and trim it with small value

micas to get an exact 2 mf. nolan

Date: Thu, 05 Aug 1999 16:07:57 -0500
From: "Dr. Gerald N. Johnson, P.E." <geraldj@ames.net>
Subject: Re: [R-390] Re: Recap shopping list

I think I'd use a 0.18 in parallel with a 1.8. Then if I was picky I'd get out the GR bridge and shoot for closer. Maybe could use a 0.018 and a 0.18 and a 1.8 for a nominal value of 1.998. There's surely room in the box for all three... I see some 1.0 mfd in other brands of polyester caps in a recent Mouser catalog. Two of those might begin to be close..... and might fit a flat box better.

I was thinking I had a sack of 2.0 mf Orange Drops from 20 years ago, but found they were 5.0 mf at 200 volts.

We need to check the temperature and drift specs for the plastic capacitors, they might not hold better than 10%, though polystyrene are pretty good.

However a polystyrene capacitor would be comparatively huge because the dielectric constant of polystyrene is low.

There is often a trade off between stability and dielectric constant. Definitely the case for ceramics, probably plastics too.

Date: Thu, 05 Aug 1999 17:18:20 -0800
From: "Larry Shorthill" <r41656@email.sps.mot.com>
Subject: [R-390] Caps other than Orange Drops

I found an interesting site: http://www.dei2000.com

This is the web site for Dearborn Electronics, which at one time was the film capacitor division for Sprague. These guys specialize in mil spec, aerospace, and higher end film and film/foil caps. They have several lines of non-hermetically sealed axial leaded metalized film and film and foil caps that look like they would drop right in in place of fiddling around with Orange Drop radial leads. I don't know anything about them and their distributor list isn't anyone I recognize (look like they have setups in all the hot bed areas for aerospace industry). I don't know that they are very affordable compared to our favorites, but if someone knows about Dearborn or their products, please let the list know. For what its worth, they also note that SMPS and Smoke detectors are listed as some of the applications for a couple of intersting product families. I would think that at least in smoke detectors, cost would be an issue. SMPS, or Switch Mode Power Supplies, are also competitive on cost, except maybe for mil and

aerospace varieties. Anyway, as someone about to make an investment in some new caps for a long project ahead (3 radios to redo), I want to get the best I can for my effort. I am not entirely satisfied with Orange Drops, since they are the wrong form factor and they have very stiff plated steel alloy leads. I know they can be made to fit, but a drop in replacement would be so much easier. I know Dr. Jerry has a lot of respect for OD's and I have a lot of respect for him, but Dearborn was the division that Sprague had in place for film caps. SBE (SBEngineering) got the Orange Drops on a buy out or spin out of Sprague, and Dearborn was cut loose in 1992. There has to be something here. If anyone has knowledge or experience with Dearborn let us know.

Date: Fri, 06 Aug 1999 20:59:38 -0500
From: "Dr. Gerald N. Johnson, P.E." <geraldj@ames.net>
Subject: Re: [R-390] Measured SMALL Capacitor Values

First thing is that small (under 10pf) capacitors often have a wider tolerance, as much as +/- a pf. The you have to take the leads out of the measurement, because the exposed leads can vary a pf or more according to their position. the best way to get a consistent measurement is to make the lead connectors hollow to hold the leads and leave none exposed during the measurement. Then you have to sure the meter reads zero with the hollow connectors in place, or you have to take that tare off the reading. The other alternative is to remove the leads or wad them up in a tiny space. Either of which makes it harder to use the capacitor later.

Its important to know the measuring frequency and keep it low enough that lead inductance is a long ways from bringing the capacitor to series resonance. This consideration gets to be more of a problem with paper and polyester capacitors that don't have extended foil construction because their rolled up construction gives them considerable inductance. That complicates both measurement to precision and application. Chuck Rippel notes that the receiver gain is a little higher when the coupling capacitor to the mechanical filter is paper than if its the same value in ceramic. I take that to show that the winding inductance of the paper capacitor is part of the tuning of the mechanical filter input circuit and the ceramic disk lacking that inductance isn't quite resonant.

There used to be capacitors (in the black beauty line) offered to be series resonant at 455 KHz to provide more effective bypassing with smaller physical sized capacitors, and thus cheaper capacitors.

Electrolytics need to be on the high side when new, because they only go down in value with age as the equivalent series resistance rises.

I checked a couple references for temperature coefficients of these paper

alternatives, but didn't find anything consistent. I see a book on capacitors deep down a pile, I'll get it out eventually and see if it gets that specific.

The most compact of ceramic capacitors will change value just from the heat of picking them up to put them in the bridge. Some will loose 80% of their C when their temperature rises 100ÅáF. Circuits using them should have been designed to work with that reduced capacitance.

Generally all uses of capacitors should have been designed to meet performance specifications with all the capacitors values at the low limit of their original tolerance and to go as low as the temperature effects create.

The exception to this wide tolerance for value is in the capacitors used to make tuned circuits, whether as RF or IF amplifiers or as oscillators.

Their stability is very important, both short term, from temperature, or long term drift. Long term drift generally can be recovered by realignment.

Date: Tue, 17 Aug 1999 12:41:36 -0500
From: Nolan Lee <nlee@gs.verio.net>
Subject: Re: [R-390] ReCap Kit R390A

>I cannot find a source for: 2 ufd 500V CC551 oil-filled paper
>so, I will toss in a 2.2 ufd electrolytic which should work.

I wouldn't use an electrolytic here, the AGC circuit will not work properly. An electrolytic has a very high leakage factor compared to the paper capacitor that was originaly used there. In addition, electrolytics are polarity sensitive and if I'm not mistaken, the polarity of the AGC voltage on C551 is reversed between the med and slow switch positions which would cause even more leakage in one of those positions, depending on polarity, and greatly effect the AGC voltage.

I don't have the manuals handy, but if I'm not mistaken, the voltage that the cap normally sees is very low, somewhere around 10 or 20 volts or less. The reason that a rather expensive oil filled 500 working volt paper capacitor was used, even though the actual voltage is a mere fraction of that, was to minimize electrical leakage. I suspect that "zero" leakage was the target or they would have used a less expensive capacitor.

Use something like a 1.8 or 2.2 mf CDE dipped "poly" cap. With the improvements in capacitor design over the last 40 years, I suspect that a much lower voltage rating for a modenr replacement would work, but

when I restuff the two dead C551's that I have, I intend to use the highest voltage rating capacitor that will physically fit inside the cans, probably 630 volt ones.

Probably one of the hardest circuits for the average person to trouble shoot in the R-390A is the AGC circuit. Going a little overboard on the caps used in that circuit is cheap insurance and in the long run might prevent hours of head scratching and premature balding. :-)

>I must say, however, I have 5 R390A radios and not one has ever had C551 to >fail.

I hadn't either up until last year. I scraped a pair of IF decks and both had leaky 2mf caps. Real leaky. ;-(

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

While working on a Collins order no. 8719-P-55 R390A that my son Derrick purchased from Jim Stagg several weeks ago, I encountered a symptom that seemed to be listed twice on the "R390A Common Failures" section of Chuck Rippel's site. "Distortion/low-audio/limiter" suggested that replacement of C549 would cure it.

This receiver started doing it after running for several hours with a box over it. I knew it wasn't C549, because I had already replaced it before this test. Next I replaced C536 as suggested further down the list. It didn't seem to help. When the receiver ran for an hour or so it would go very low and distort. Turning on the limiter brought the audio almost to normal. The culprit was: C532 a 100pf mica between pins 5 & 6 of V507B and ground. It was quite leaky when it got warmed up. <snip>

Has anyone ever found a satisfactory replacement for C551 2uf @ 500vdc ? I have used a 2uf @300vdc round shaped cap that tested with very high insulation resistance, that was oil filled and had good hermetic seals. I've done this on one receiver 3 years ago and it has held up well. The cap originally came out of a Hughs' Electronics Avionics unit that I bought in the late seventies to salvage components from to support my restoration hobby. Thanks for the bandwidth. If anyone has some feed back, I'll appreciate it. w4net@carneconn.com

PS the IF strip was serial number 1534 and the front tag said 1725, so I'm pretty sure they were from the same contract.

Date: Mon, 06 Sep 1999 18:41:53 -0500

From: "Dr. Gerald N. Johnson, P.E." <geraldj@ames.net>
Subject: Re: [R-390] Another failure of note.

Ahah, you have proven that micas can fail. But its not common. Hosfelt's current catalog shows a 2 mfd polyester capacitor with radial leads... Might be a solution for the big oil capacitor. They also have 1.8 and 2.2 mfd. 800-524-6464 if I remember right. If wrong swap the 5 and 6s.

From: Christian Fandt <cfandt@netsync.net>
Subject: Re: [R-390] Old Capacitors

>What should I do with the shiny, black, hard Spragues with the yellow lettering and yellow band????

Well, there's a reasonable chance one or more could have gotten leaky as a result of the molded case fracturing along the mold separation line or at the case-lead interface. Often can't see a crack as they can be microscopic. Caused by thermal cycling typical in a radio during operation or storage. Years of temperature changes allow the cap to 'breathe' moisture into it which permeates the paper dielectric thus dropping the resistance down far enough to cause problems. Sometimes to the extent of the cap heating up fast enough because of a very low resistance to actually burst the case. Those infernal "Black Beauties", which have colored band marking the value and tolerance and made by I think Cornell-Dubilier, are seemingly the very worst in reliability. I've seen early TVs and other radios filled with them setting in an old TV shop's parts/junk pile. Close inspection revealed some of those caps with very visible cracks along the separation line. I've had one Black Beauty type burst in an old broadcast set I'd fired up after years of being idle. Electrolytics can fail in a similar fashion but more likely from not being 'reformed' before having full circuit voltage slammed onto them at power up. They can occasionally burst with a _much_ more dramatic effect though.

Even if there are no apparent problems with the set's operation up to now, as long as you're in there and having so much fun, I suggest to just change 'em :) This is an old subject of discussion. Rumage through the archives of this list for some rather thorough discussions on capacitor failures and good replacement types with regard to our R390x receivers. Discussions are generally applicable to your old comm. rcvr. --and any other older radio and TV for that matter.

Date: Fri, 24 Sep 1999 09:00:13 -0500
From: "Dr. Gerald N. Johnson, P.E." <geraldj@ames.net>
Subject: Re: [R-390] Old Capacitors

Sprague black beauties whether with the yellow lettering and yellow band

or with many color coded bands are the scourge of old radios. They develop leakage in such proportions its my experience that its not worth the effort to check them. Just replace every one of them, you'll accomplish more restoration in the time available. If you do take time to test them you will find them all leaky. Use Orange Drops from Sprague. They haven't yet developed a consistent trend to get leaky. Very few of them have failed and I've been using and testing them for 30 years or more now. Even abusing samples running them through the wash in my jeans pocket without damage. 73, Jerry, KOCQ

Date: Wed, 20 Oct 1999 19:37:42 -0400
From: "Tetrode" <tetrode@sprynet.com>
Subject: Re: [R-390] Progress Report... + RF Deck Problem found

>So now its on to the RF deck. The first obstacle seems to be what to do about C227. It looks like >to get at the stud nut to loosen it requires removing at least half a dozen components around the >RF Amp. Any suggestions on how to deal with this one?

Yup, I had a problem with that cap going bad, so its worth checking out or replacing while the RF deck is out. My 67 EAC had a problem where the front end was going into oscillation on the higher bands, it would jump in and out of oscillation as the antenna trimmer control was rotated.

Luckily, about the same time as I was recapping, Nolan Lee reposted one of his capacitor emails which warned about that stud-mounted cap near the 6DC6. I was like, what stud mounted cap? It was unmarked, and I had overlooked it, probably thinking it was a bolt or something. First time I ever saw one of those types. So I clipped it loose from the circuit, and it was definitely bad, almost open, and its reading was actually jumping around between 100 and 200 pf.

Because its reading was jumping around I decided not to simply put a new value in parallel with it; it might make for a noisy front end (C227, .047 uF, is the primary cathode bypass for the 1st RF amp). So I just left its body in place but left it clipped out of the circuit. I agree that it is in a difficult spot to get too. I didn't have any suitable .047s kicking around at the time, so I made one up out of 5 .01 uf 100 volt ck05 ceramics in parallel that I had a bunch of. It just happened to measure out to .047 uf :^).

I chose to install the new cap pack right above the tube socket so it would have the shortest leads possible, but that may not have been necessary. Even though the lead from the original C227 is actually quite long, my RF deck had the mod which puts an additional 47 pf cathode bypass right at the tube socket in order to efficiently bypass the high frequencies. At first

I didn't think that a missing cathode bypass would cause instability, but without it, the cathode is free to pump RF (and receive RF) throughout the wiring harness, so who knows where the feedback path was.

There was a other work I did in the RF deck too, but the bottom line was that after fixing that cap the front end is now uncondionally stable like its supposed to be.

Date: Thu, 11 Nov 1999 20:09:15 -0800
From: "Gene G. Beckwith" <jtone@sssnet.com>
Subject: Re: [R-390] CV-591A -- problem solved -- status report---

Once it was determined the problem was in the LC network that is shunted across the "Manual" variable cap...the one used from the front panel, it was time to bite the bullet and go after the coil can Z3..actually it's an easy by comparison job...four bolts from bottom of chassis...easy to get to and three wires...be sure to sketch locations for reassembly, just in case... The can contains the coil and a 430 pf mica...those nasty, nasty little red ones like are used on the '390x mechanical filters...I've heard from different sources that when those little fellows were first introduced, they eventually gained a reputation for going bad...not sure what that means, but when I saw that cap, I knew I was on the trail...plus Dr. Jerry advised of an open cap some place in the area...

Clipped it out...didn't want to add heat to phenolic and risk damage to the coil...checked coil for continuity and all was well there (its center tapped btw).. .but, the cap when checked for continuity...showed "OK" ..Whooops... what this all about...)^&$&_(*!! its supposed to be bad after all of this effort...so...next step was to try the Tektronix type 130 cap meter...(got it for a few bucks and five of Missy Marilyn's home made chocolate cookies at the Cleveland Hamfest this summer (the seller had the nerve to tell me it actually worked!)...

When I tested the 430 cap, no reading on the meter...this was good...i.e, the cap was bad...But, not trusting the Tex...I grabbed a few other similar ones from my meager supply, and sure enough the old Tektronix was showing values consistent with their markings...Yippeeeee!!! I found the little bugger was really bad! Gosh...How sweet can life be..?

Once reassembled, and the "CV" tied to the "ST. J.," it really came alive...and of course with a bit of tweeking to get everything lined up...the battle was over..

Post script...

1. Not sure why my VTVM didn't show anything...could do a more carefull

check to see if there was some leakage...but first checks said all was ok...?

2. The direct reading Tektronix showed "no" farads...coming in or out... (grin)... actually got no indication of reading, but good caps read perfectly confirming the 430 was bad...could it have disconected itself in side, so it would look open to continuity...and also show no capacity...??

3. Once the CV was up and happy, the whole adaptor came alive, in the sense that over all gain was tremendous compared to previous..both in Xtal and manual mode...I suspect the LC circuit was, in some way, messing up the oscillator, maybe leaky in a way I don't understand...

4. That pesky relay turned out to be not too difficult to clean up and seems to work fine...used "Deox" in several doses, plus bunishing contacts with clean strips of news paper...news paper is quite abrasive (in more ways than I have time to describe) and work quite well as a gentle contact tool...

Finally, will finish up replacing a few remaining paper caps, do a bit more cleaning, and add fresh electrolytic to ps under chassis..then for some operating time to see if its as good as people seem to suggest... Best Regards to all..hope this helps someone else..and btw...am now totally suspicious of those little red nasties...and plan to check the ones around a dead 8kc mech filter in a spare deck before pronouncing the filter is bad...

Date: Thu, 11 Nov 1999 19:22:47 -0600
From: "Dr. Gerald N. Johnson, P.E." <geraldj@ames.net>
Subject: Re: [R-390] CV-591A -- problem solved -- status report---

>The can contains the coil and a 430 pf mica...those nasty, nasty little red ones like are used on >the '390x mechanical filters...I've heard from different sources that when those little fellows >were first introduced, they eventually gained a reputation for going bad...not sure what that >means, but when I saw that cap, I knew I was on the trail...plus Dr. Jerry advised of an open >cap some place in the area... It just had the symptoms of an open capacitor, I figured a >variable. Clipped it out... <snip>

Yup. The red capacitors are molded silver(ed) mica. Which means that sheets of mica are painted with silver paint and stacked in a pair of pressure clips that are welded to the lead wires. Then they are either dipped in red epoxy or molded in red phenolic (with color code dots different each 7.32 years to keep users confused). Age and moisture can upset the pressure connection or the painted surface. Defects in the mica tend to lead to leakage, but changes in capacity or even opens as you found can happen. There's silver plated clips against silver paint, nearly the same problem as in the ceramic trimmer capacitors that of silver sliding on silver, not a welded or soldered connection.

Plain molded mica capacitors (some color of tan or brown) use foil for the metal instead of paint and probably don't go open as often, but since the metal isn't as intimately against the dielectric, they don't have the capacitance stability of the silvered mica variety.

> 4. That pesky relay turned out to be not too difficult to clean up and
> seems to work fine...used "Deox" in several doses, plus burnishing
> contacts with clean strips of news paper...news paper is quite abrasive
> (in more ways than I have time to describe) and work quite well as a
> gentle contact tool...

Its usually considered abusive enough to use cotton bond paper (the kind your lawyer uses) which has better control of the inclusions than newsprint which could have chunks of metal, wood, wood bark, and oily inks to leave damage or further complications behind in the relay contacts.

> Best Regards to all..hope this helps someone else..and btw...am now
> totally suspicious of those little red nasties...and plan to check the
> ones around a dead 8kc mech filter in a spare deck before pronouncing
> the filter is bad...

No capacitor is ever totally beyond suspicion when there's a circuit malfunction, but mica and silver mica tend to have very high reliability. Infinitely higher than black beauties and electrolytics, but that just means that black beauties and electrolytics probably have already failed unless just made. I think its better for the radio to trouble shoot mica (unless the coupling capacitor to the mechanical filters) than to yank each one out for testing on a capacitance bridge. Besides the micas tend to be used in RF and IF circuits where lead length was a critical and once they are out, they may not have enough leads to go back. And with solid wire leads, the odds of removing 100 capacitors and having 200 leads connected to them is about zero, probably break 20 off flush with the case. If voltage checks don't show them shorted, its not a big problem to try a spare in parallel when the symptom makes the capacitor look open. Leaky capacitors, the more common failure mode, aren't tested by paralleling another capacitor most of the time.

Problem R390A Components by Chuck Rippel

IF Deck

I am often asked if there is a "Laundry List" of problem capacitors that should be replaced in the R390A. Until recently, the answer has been limited to C-553, the capacitor which blocks B+ from the mechanical

filters plus "any others which test defective." There are now several which I pre-emptively replace because they consistantly turn up as defective across the many receiver restorations I have performed. While most are in the IF deck, the RF deck and Audio Deck also have a few. To the right, you see 3 capacitors which have proven to be a problem and were replaced with Orangedrop types. C-531, C-547 and C-549. These have all been the cause of audio and Limiter function problems.

C-553 is the plate blocking capacitor for V-501. It is rated .01ufd at only 300VDC. Failure of C-553 will cause catastrophic failure of the 4 Collins mechanical filters as B+ is applied to them then shorts to ground until the filter burns open internally. I routinely replace this capacitor with a .01ufd, 600V Orangedrop type. Notice how the new orange colored capacitor
is dressed into the corner of the filter compartment in the bottom of the IF deck. Because of the voltages involved, the leads are also covered with teflon "spaghetti." The plate choke, L-505 can bee seen directly to the left of the "new" C-553.

Audio/Power Supply Deck

A common failure that is often overlooked involves the 2 multi-section, electrolytic capacitors mounted on the AF deck. No matter what the age or condition of the receiver involved, these capacitors are probably electrically leaking causing undue stress on the power supply and, as they also serve as cathode bypasses in the audio section, some measure of audio distortion. In the worst cases, as in the picture at the right, acid actually seperates from the from the electrolyte and begins leaking out the bottom of the capacitor.

While electrolyte leakage in itself is not indicative of a filter capacitor failure, it does indicate the capacitor is at the end of its service life and must be must be changed or rebuilt. Click here for information about having the electrolytic filter capacitors rebuilt. Another high-failure capacitor is C-609, also located on AF chassis about midway on the main (and only) circuit board. C-609 is an 8ufd electrolytic and serves as the cathode bypass capacitor for V-601A. Again, the acid leaches from the electrolyte and will destroy the capacitor sometimes actually only the 2 soldered in leads. I replace this component with a 8ufd 35V available from various commercial parts houses. However, a 10ufd, 35V replacement is available at your local Radio Shack. Note in the picture that I have placed a "+" on the end of the board. Electrolytic caps are usually polarized and you should make sure to orient the replacement capacitor with the positive end as shown.

RF Deck

There are several concerns in the RF deck. By far, the most common, re-occuring one involves the receiver not working well or perhaps not at all on the lower bands. Checking the output of the first crystal oscillator circuit of V-207 at J-221 reveals a peak to peak output of perhaps a few hundred milivolts instead of the 3+ volts. Tuning the transformer, T-207 will not correct the condition. This is caused by C-327, a 100pf mica capacitor failing. It is across the primary of T-207 and is accessed from the underside of the RF deck as below. It should be replaced by a 100pf, 1KV ceramic disk capacitor and the circuit re-aligned.

Date: Mon, 13 Dec 1999 23:44:54 -0600
From: "Dr. Gerald N. Johnson, P.E." <geraldj@ames.net>
Subject: Re: [R-390] Leakage Curent

Just replace ALL the old paper capacitors. They will average rather leaky. Compare some of them to new orange drop capacitors. Then you will KNOW how they compare. The pickiest coupling capacitors are probably those to the output tube grids. Half a meg grid resistor, a few volts grid bias from a cathode resistor. A microamp of leakage means half a volt change in grid bias. And with 150 volts across the capacitor that means 150 megohms... So you probably want ten times that as a minimum resistance. Another consideration is that once leaky, a capacitor often tends to get leakier with age and heat. And that leakage, if not steady, can add noise. Circuit resistances are considerably higher in the AGC circuits. And lower in bypasses, but since leakage currents increase with time there's not much need for allowing them. The megger and the electrolytics won't get along, the megger will show them essentially shorted. There a bridge that shows power factor is more important to proper operation, and power factor should be small, under a few percent. Again compare old to new. Then replace without question. Electrolytics age significantly more rapidly than paper, even faster when not used.

Date: Tue, 28 Dec 1999 10:14:08 -0600
From: "Dr. Gerald N. Johnson, P.E." <geraldj@ames.net>
Subject: Re: [R-390] RF deck 5000pf capactiors

Every component, even the steel chassis can fail, but not necessarily often. Ceramic capacitors can fail, but not so often that its worth replacing them all. Is that 5000 pf disk running warm, or drawing current? if so its in need of replacement. Resistors are affected by age, heat, and humidity, each a little differently. Some fail sooner than others with the same stresses, though most resistors aren't run at precisely the same power dissipation so react differently. Sometimes a leaky bypass will add to the

dissipation and cause a resistor to fail as a marker pointing to the leaky bypass capacitor (or socket).

Date: Thu, 06 Jan 2000 13:40:55 -0600
From: "Dr. Gerald N. Johnson, P.E." <geraldj@ames.net>
Subject: Re: [R-390] MusiCaps by Hovland

From having started using Orange Drops since they first came out in the late 50s and having had no failures, nor no detected leakage as the result of abuse such as leaving them in my pants pocket to go through the wash, I have lots of confidence in them. There may be others as good, but I haven't abused them as much to know their toughness. The molded paper rather than the polyester insulation capacitors have never had great quality and don't last well, molded, dipped, or whatever. Kraft paper and oil just doesn't have the insulation resistance of polyester film. I've used a few Cornell-dubilier molded polyester caps with good results but they are sometimes a lot harder to buy than Orange Drops. In 455 KHz IF circuits, its likely that disk ceramics aren't quite as good a capacitor for bypass as SOME wound type capacitors because the wound capacitors can be close to series resonant and so present a lower impedance than regular capacitors, though the flat slab, two leads disk should present a fairly low impedance. Sprague used to make some capacitors in the black beauty line that were intentionally adjusted to series resonance near 455 KHz. I've encountered few polystyrene capacitors as compact as disks or with as robust leads. All my collection has really small wire in the leads which adds inductance and fragility. Silver mica probably will be good replacements for all bypass type dog bones, but not necessarily the best for the temperature compensating types (typically not dipped). Replacements for temperature compensating types is a big problem... Note that N075 capacitors are more predictable than NPO.

Date: Thu, 06 Jan 2000 22:33:52 -0500
From: Barry Hauser <barry@hausernet.com>
Subject: Re: [R-390] Capacitors

I could really use a copy of "Capacitors for Dummies". From following the lists, what I've gathered generally is this:

- -- Orange Drops or equivalent mylars are favored for R-390(x) replacement of BBOD's.
- -- When you encounter an SP-600 that doesn't have BBOD's or GLOD's, it's cause for celebration, but what you'll find are ceramic disks, as you will on the later editions of the HQ series.
- -- When replacing waxworks caps on old Hallicrafters, I've been advised to use yellow polyester axials.

Apparently, the downside of the OD's is that they're sometimes a pain to position because they're basically radial lead. (I seem to remember turquoise colored ones that were axial once upon a time.) Some have had excellent long term results with the polyesters or polystyrenes, however they can be problematical in tight spaces where your soldering iron might melt them. As for ceramics, I always thought those to be among the most durable, providing the coating was intact.

Then there's the question of mica's -- regular vs. silver -- what can these be replaced with. I've seen some that were split. How do you identify an old silver mica from a plain old mica? Do all of the old ones have the same rectangular molded domino shape? Didn't some old ceramics come in that package?

I guess what I'd like is a "one if by land, two if by sea" guideline on these. Oh, BTW, then there's the question of type of ceramic -- temp. compensation, etc.

Only thing clear, is almost nobody is going for NOS Black Beauties. Otherwise, the older I get, the more I read, the less I know. Or, in more succinct terms: Duh, huh?

Date: Fri, 07 Jan 2000 00:14:30 -0600
From: "Dr. Gerald N. Johnson, P.E." <geraldj@ames.net>
Subject: Re: [R-390] Capacitors

> I have found that Mylar and other "modern" caps are available at pennies.....

Polylester isn't authentic either, but it cures some of the noise makers of that era auto radio.

> I guess that the purists can make an issue for the old Millen and
> Measurements grid-dip oscillators's. I still have my Measurements #59 with >the LF, MF >and UHF heads/coils and the National Radio ID tags and find >them extremely usefull even >here in '00..

The Measurements model 59 is a good dipper. Mine is not available for swap or sale. I wish I had the UHF head too.

> I have seen so many different silver mica specs that I've lost track....

I don't know the TC for silver mica. Its not quite zero but better than a lot of ceramics. There is likely some variation since the dielectric is a natural product, not man made.

Date: Fri, 07 Jan 2000 01:36:57 -0800
From: eengineer@erols.com
Subject: Re: [R-390] Capacitors

I realize Barry is probably making a joke, but here are two references I have which are VERY good if you are interested: "Passive Components - A Users Guide" Ian Sinclair, pub. by Butterworth-Heinemann paperback, a REAL good book on all passives, wire, connectors, PC board material, etc.

"Troubleshooting Analog Circuits" Robert A. Pease, EDN series for Design Engineers, also pub by Butterworth-Heinemann. Mine's hardback and autographed, I have seen the paperback versions at Border's Books (if you have one closeby) Bob writes "Pease Porridge" for EDN.

Date: Fri, 07 Jan 2000 00:38:46 -0600
From: "Dr. Gerald N. Johnson, P.E." <geraldj@ames.net>
Subject: Re: [R-390] Capacitors

There are other makers besides Sprague, probably of good parts. I just like the OD because I've had some for a long time and they stood up to my abuse way back and still are good. Strictly speaking the Sprague company has been broken up and split out and the closest thing to Sprague is the Vishay company who bought the OD part of Sprague. As noted by KM1H, Mouser sells OD and Sprague electrolytics with the classical part numbers and values. Last week I got two day delivery to Iowa from Texas on an order for some. I hadn't noticed the Panasonic/Sprague equivalent numbers in Digi-Key. I'll have to look the next time I get close to a recent catalog.

Date: Fri, 07 Jan 2000 00:38:56 -0600
From: "Dr. Gerald N. Johnson, P.E." <geraldj@ames.net>
Subject: Re: [R-390] Capacitors

-- Orange Drops or equivalent mylars are favored for R-390(x) replacement of BBOD's.

There are other brands, C-D and Panasonic, but I don't have the length of experience with them like the OD, and until very recently C-D were hard to find.

> -- When you encounter an SP-600 that doesn't have BBOD's or GLOD's, it's cause for >celebration, but what you'll find are ceramic disks, as you will on the later editions of the HQ >series.

Those were probably from Cornell-Dubilier.

>Some have had excellent long term results with the polyesters or polystyrenes, however they >can be problematical in tight spaces where your soldering iron might melt them.

I don't remember melting any OD. I was thinking that Orange was more like an epoxy than a thermoplastic.

>As for ceramics, I always thought those to be among the most durable, providing the coating >was intact.

I don't consider ceramics to need blanket replacement like I recommend for paper capacitors. I've found only a few ceramics that have been bad.

>Then there's the question of mica's -- regular vs. silver -- what can these be replaced with.

The dipped silver mica replace both silver and plain mica. Silvered mica have the electrodes painted or deposited on the mica and so have no air variable air space. That gives them better stability. Plain micas have mica sheets interleaved with foil capacitor plates. The inherent air gaps of such construction destroy their stability.

>I've seen some that were split. How do you identify an old silver mica from a plain old mica?

Old silver micas will have a red color in the molded case. Plain micas are generally some color of brown.

>Do all of the old ones have the same rectangular molded domino shape?

Yes, some with 5 spots, some with 6, and not all with the same number of spots with the same meaning.

>Didn't some old ceramics come in that package?

Both ceramics and paper came in molded packages (generally larger) looking like micas. And micas came in several sizes of package too.

>I guess what I'd like is a "one if by land, two if by sea" guideline on >these. Oh, BTW, then there's the question of type of ceramic -- temp. compensation, etc.

If in a tuned circuit, ceramic capacitors need to be NPO or better. If in an oscillator there may be some other temperature coefficient used and getting the same is important to maintain stability. That is not easy to accomplish. Few distributors even know what TC is much, less carry

capacitors other than GMV or NPO.

Date: Fri, 07 Jan 2000 09:40:30 -0500
From: Roy Morgan <roy.morgan@nist.gov>
Subject: Re: [R-390] Capacitors

The Sprague Company of Adams Massachusetts now no longer makes the "Orange Drop" line of capacitors that they originated many years ago. Production has been taken over by another company. Details have been posted on audio-related mailing lists in the past (such as rec.audio.high-end). You may be able to locate those posts through archives of such lists. In *MY OPINION*, the modern capacitors are every bit as good as the old ones, especially for use in R-390's and such radios.

Date: Fri, 7 Jan 2000 13:33:06 EST
From: DAVEINBHAM@aol.com
Subject: Re: [R-390] Capacitors

>I have replaced paper caps with disc ceramic up thru .1mF for the past 35+ >years with no >obvious problems. Higher values (or voltages) are whatever I can find in "by the bag" lots >at fleamarkets, surplus stores, etc. In critical RF circuits, the old dogbones get replaced by >either silver mica, NPO disc, or polystyrene. While at National Radio I used to put a label >with my name and call on the bottom cover or inside the chassis of radios I recapped for >customers. I still get mail and calls from new owners wondering if I will rebuild their other BA >since the HRO or whatever I did in the '60's is still running fine. Getting to 390 specific, what >are the caveats? Tnx Carl KM1H >>

Bottom line first. You rather eloquently stated what you did at National and it has stood the test of time. No one can argue with success. I have been doing electronics as a hobby since 1953 and as a way to make a living since 1960. With luck, I often learn something new . I asked the question about the MusiCaps to see whether anyone on this net has ever actually had any experience with them and do they make any difference that one can actually hear or are they simply high priced BS. So far, no one has replied who has actually used them. Several have replied with opinions that they are BS. I, personally, have no opinion as I have no personal experience with them. I suspect the opinions expressed here on this net are probably correct or close to it, however, it would still be nice to talk to someone with actual experience with these capacitors. The general consensus expressed here on the net and emails to me privately is "you can't beat Orange Drops." I am not so sure I would toatally agree with that. I , however, hasten to add Orange Drops are probably as good as or better than the capacitors that came in our R-390's new. Orange Drops were , I think, invented in the 1950's. There are better capacitors out

there but I personally can not justify the higher price for use in a non-critical application such as an R-390. Regards, Dave

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Date: Fri, 07 Jan 2000 13:43:29 -0500
From: tbigelow@pop.state.vt.us (Todd Bigelow - PS)
Subject: Re: [R-390] Capacitors

'Orange Drops' are now produced by SBE in Barre, Vermont - in the former Sprague capacitor plant there(well, a smaller portion of it, at least). A local fellow bought the remnants from Sprague when they wanted out, and has turned it into a nice little company. I have several friends who work there, two fellows who are hams and the wife of another friend who is a ham(she has her ticket, too). Needless to say, they take good care of me in the 'Orange Drops' department (brag, brag). If anyone has specific questions on certain types, sizes or needs, I'd be more than happy to take them to someone who would listen. They do make some nice little 'kits' with several different sizes of caps in each, with multiples. And they deal only through their distributors at this point. But, like any company that pays attention, they're always looking to improve sales and service. I've fwded many an email with O.D. praise to one of my friends there for the marketing dept., just to let them know how much we appreciate their product and how much it is used. Hey, every little bit helps. ;) Gimme a holler if I can help out, it's only 15 minutes from work and 25 minutes from home. 73, Todd/'Boomer' KA1KAQ

Date: Fri, 7 Jan 2000 21:27:09 -0000
From: "Rick Blank" <rblank@texas.net>
Subject: Re: [R-390] MusiCaps by Hovland

I guess the basic question would be: "Do designer capacitors make a difference in the sound of a piece of gear?" The answer would be, it depends! When you have a piece of true hi-fidelity gear, it's amazing what the differing components used can do for or to the sound...yes, I have heard the differences in capacitors, resistors, and wire, but, most people have not trained their ears to hear the subtle differences and attach meaning to what they hear...it's a long and difficult process and it takes listening to progressively better gear and then comparing it to not as accomplished pieces to really get a handle on what is happening with the sound. In something like our BA radios, I fear that the degree of refinement and increased resolution that these capacitors give in high end audio gear would be totally lost in the machine...for instance, with our R-390's, the audio amplifiers range does not extend up into the 7kHz and above range that any good piece of modern hi-fi gear will do...and it is in the treble that I hear the most difference in caps as to their quality...some sound "hard" or edgy, some soft and diffuse, some are neutral, some are warm or cold, all in the same circuit, just subbing the

caps! I could go on more, but I think you get the idea. For instance, I work part time for a high end audio dealer. This week, he is at CES...needless to say, I asked to bring home a few things to listen to while he was away...one of these is a new $3500.00 Dodson Audio digital to analog converter for CD transports, and three sets of 1M interconnects, the cheapest of which retails for $500.00, and the most expensive for $800.00 a meter! No, I am not considering buying these, I just listen to them in my system, which I know very well, and compare to a "baseline" if you will. Well, what can I say? This new DAC makes me want to throw rocks at the $1000.00 DAC I bought (on closeout for half that) two years ago..it makes a CD sound closer to a good quality analog LP than any of the other (read: expensive) DAC's that I have listened to. And the cables? Well, I know that the differences in sound can all be attributed tot he differing LCR of the cables, the dielectrics used, and the geometry of the conductors...but, although they all come from the same manufacturer, they all have a different sound.....go figure....still, I'm too poor to afford this stuff, but it's fun to play with! But as far as our radios and RF circuits are concerned, I feel that there would not be enough of a difference to warrant the cost of the exotic capacitors....but, there may be a cause to use some of the excellent resistors out there in different parts of the RF circuits to reduce the noise that resistors can have....I have had this idea to take one of these Navy surplus KWM2-A's that I have around here and rebuild it using designer caps, resistors, and wire and see what happens! Too many real projects, though, to get involved with that any time soon, though! Have fun! Orange Drops are great for the audio sections of old radios, there's nothing wrong with them at all in this application!

Date: Sat, 08 Jan 2000 23:11:18 -0600
From: Nolan Lee <nlee@gs.verio.net>
Subject: Re: [R-390] Signal generator connection questions

<snip> Dallas mentions that the Vitamin Q types do not normally require >replacing. Why not....since they are also paper? Do they go bad in the 390xx ?

The old Vitamin Q's were probably some of the best constructed paper caps made. Oil filled and heramically sealed with glass and metal. Of all of the caps that I've removed from the various R390A's and modules, they failed the leakage test the least often. I'd still replace all of them in the receiver while you're "in there". Cheap insurance over the long haul. When I did the audio deck on the EAC, I used some NOS Vitamin Q's that I'd been saving for some of the locations on the circuit board where I didn't like the way that the Orange Drops fit. I tested the hell out of them a little over their rated voltage and they were perfect. I even left them at full operating voltage on one of the PS's for a couple of days and then retested them. I guess that they aged well. The only deck that I'd even consider using NOS

caps like that in would be the audio deck. It's about the easiest to remove. As much trouble as it is to remove the RF deck, only new over rated OD's are used there. It's not worth trying to save a dollar and a half and having to pull the deck down the line somewhere. Ditto for the caps in the IF decks on account of the amount of effort it takes to replace them in the first place. Finding any NOS Vitamin-Q's any more is tough as hell. It seems that the golden eared audio crowd has discovered them. I saw some listed a while back at over three bucks apiece for 30 year old NOS ones. No thanks, I can buy 6 times as many new Orange Drops for that. ;-) They "sound" good. Hell, I can't carry a tune in a slop bucket, I could care less how capacitors or rectifier tubes "sound". <grin>

>Another comment he made in the cover letter was to change the AC power
>filter chokes with Miller 4622's; the originals were underated and
>overheated, splattering red gook inside the filter case.

Mine had already been relocated and replaced with updated parts. There was no evidence that the original ones had failed. Relocating them is a good idea. My URM-25D model has matching SN plates on the case, front panel, PS module, etc. Upon close examination, the big orange plate on the top of the cabinet showed that it was a URM-25G that had been over stamped as a D model. One good thing about the G model is that the adapters that came with it had late design high quality dipped resistors that hadn't changed in value at all. The adapters that used conventional looking carbon composition resistors need to be checked for out of spec resistors. Comparing the schematics and parts listings from the URM-25G and H manual, my D model is actually a G model with it's extra 12 volt transformer winding and a zener diode regulated filament supply for the oscillator tube. The power supply in the G runs noticeably hotter than the D model but doesn't drift as much with changing line voltage. I'm looking for a copy of the schematics and parts listings from the manual on the URM-25 models later than the H.

Date: Sun, 09 Jan 2000 00:44:51 -0600
From: Nolan Lee <nlee@gs.verio.net>
Subject: RE: [R-390] Capacitors

>AES (Antique Electronics Supply) carries both the polyester and
>polypropylene types on pg. 23 of their current catalog. A. B. Bonds
>recommended the polyesters,.....

If that's the little yellow axial leaded caps, they're pretty decent. The body size is small and the leads are easy to shape. I bought some years back and they're still fine. I used some in one of the signal generators a while back, I think it was the 25F. My only complaint with them is that they're REAL

easy to damage if you "bump" the body of them with the tip of the soldering iron. Instant shorted capacitor. ;-(Homemade soldering shields made from either brass shim stock or aluminum drink cans are a good idea. They're a good idea for protecting wiring etc in cramped areas too. What I do is to order a few extra of each value anytime I order caps for a particular project. After a while, you build up a pretty decent little selection.

>They also have the SBE Orange Drops, if you need them.

I generally order most of my caps from Mouser. They're about a day closer and their shipping charges are less for small orders. I use the Orange Drops anywhere that I don't want to have to mess with again, like the IF deck of an R390A. They can be a real pain to shape the leads of and position but you can pretty much forget them when it's done. I've used a lot of the C-D caps from Mouser too. Nice flexible leads and a small physical size. They're so small for their size that the only voltage rating ones that I buy are the 630 volt ones. The price on them is a little less than the OD's.

AES has a very good selection of non-standard values of the OD's. When I rebuilt the audio pass filters in the old RBL-5, I was able to order the .005, .006, .007, etc. values from them. I didn't want to deviate from the original design as far as the characteristics. Only AES had all of the values I needed.

Date: Sun, 13 Feb 2000 18:00:54 -0600
From: "Dr. Gerald N. Johnson, P.E." <geraldj@ames.net>
Subject: [R-390] Re: [Collins] Stewart Warner/Teledyne/Capehart RF Deck so Far...

Usually coating cracking at the edge of the disk is just cosmetic. In many Heathkit manuals the first step in using a disk was to crunch off any coating from the wire leads to be able to use minimum lead length. Ceramics do fail, but with almost the inverse certainty of black beauties. The first hint of capacitor failure that I'd take would be the screen dropping or plate isolation resistor being cooked. The wire leads are soldered to the metalization of the ceramic disk most of the way across the disk so a little stress at the coating at the edge doesn't mean much. Mica caps probably fail a couple times more often than ceramics, probably more often open than leaky, but since mica is a natural material, leakage is possible. Trouble like with disk ceramics is that getting them out for testing does so much damage its easier to simply replace them with more micas if the proper values can be found. Dipped micas tend to be a little better than molded micas, but they are not 100% perfect.

Date: Thu, 17 Feb 2000 13:12:26 -0600
From: Nolan Lee <nlee@gs.verio.net>
Subject: Re: [R-390] .005mf ceramic disc / temp coefficient

>Is there any particular temperature coefficient for the scads of the .005 ceramic discs in the R-390a?..... Not that I've ever seen.

>They all look the same to me....and do not appear to have any temp coefficient markings.....

They do not. I don't have the manuals handy, but you could crossref the original military part number that's listed for the cap to see.

Date: Fri, 07 Apr 2000 09:21:11 -0500
From: "Dr. Gerald N. Johnson" <geraldj@ames.net>
Subject: Re: [R-390] Confessions of a sinner

Actually at the 455 KHz IF, paper or Orange Drops are probably slightly better bypass capacitors because of the inductance of their windings leading to a series resonance and so the bypasses are slightly more effective than disk ceramics of the same value. That's been detected in the capacitor feeding the input of the mechanical filters. The paper gets more signal through than a disk in that location. Same reason.

Date: Mon, 10 Apr 2000 12:41:47 -0400 (EDT)
From: Norman Ryan <nryan@duke.edu>
Subject: Re: [R-390] Identify R-390A caps

> I have a 62 Amelco with 3/8 diameter round black plastic caps in the IF. Are these also the >famous BlackBeauties? Or are these a newer OK type of cap? Are the VitaminQ the metal >ones with a clear plastic sleeve on them? The ends look like a white plastic plug.

Right on both counts, but the Vitamin Q (or glass sealed metal sleeve) caps are the least unreliable. Orange Drops (or Mylar or polypropylene) beat paper hands down. Wholesale replacement of any paper type caps definitely is worthwhile. Use 600V for B+ and 400V elsewhere.

Date: Mon, 10 Apr 2000 11:53:13 -0500
From: "Scott, Barry (Clyde B)" <cbscott@ingr.com>
Subject: RE: [R-390] Identify R-390A caps

I don't know about the span of years, but I think they were used well up into the '60s. What you describe is the infamous BlackBeauty (actually mine are more brown than black, but I think they came in various shades

of dark). The VitaminQ caps are as you describe them as well. Most, if not all, of mine have "Vitamin Q" imprinted on them. I don't know about their reliability, but it sure looks like most, if not all, of the BrownBeauties in mine are bad and I am suspect of the Vitamin Qs as well. It think it is much easier to just get them all while I have it apart. I purchased a replacement capacitor "kit" and all the above-mentioned caps are included in it. I sure hope none of the remaining caps are going to give me trouble. After stuffing the IF with the 0.1mfd @ 600V caps, it makes access to a lot of the other components rather difficult if not impossible. The 0.01mfd and 0.033mfd ones aren't very large, but the 0.1mfd caps are rather large. It takes some real "surgical" technique to get them in properly, but they will fit.

Date: Mon, 10 Apr 2000 13:39:28 -0400
From: Roy Morgan <roy.morgan@nist.gov>
Subject: Re: [R-390] Recapping R-390A

... With several BlackBeauties on the bench,
... I noticed a hairline fissure along its length parallel to the mold line.

You should see the ones in my SP-600. Split open from end to end with the innards clearly visible.

>While a cracked shell isn't always an indication of leakage, it would make >me skiddish to know they are in there.

The crack is a sure indication that moisture can get into the cap. This in turn can cause electrical leakage.

>Besides, the OrangeDrops sure look pretty...even if it is a royal pain to >get the 600V types in all the right places, especially in the IF deck!

That's overkill.. You can expect a new 600 volt capacitor to operate indefinitely at 400 volts. No where in the B+ system of an R-390A is there even 400 volts. Fight if you must to get the larger 600 volt units in there but you are kidding yourself if you think you need the "extra margin of safety". Spend the time instead by testing every capacitor you install at twice its rated voltage for 24 hours each. I'll bet you a 5814 that you have zero failures. Zero. Repeat, zero. Of course, it is good for us all to keep our goals in mind.

In my case, I want to spend happy hours working on my radios. Being able to complain about a radio that works poorly due to bad caps is not one of my goals. Searching for a replacement mechanical filter that blew out due to a failed cap is not one of my goals. Pulling an R-390A apart again to replace an original cap I did not replace earlier is not one of my

goals. I have plenty of other things to work on instead. That CV-591 full of little black beauties, for example.

Date: Mon, 10 Apr 2000 11:01 -0700 (PDT)
From: rlruszkowski@west.raytheon.com
Subject: Re:RE: [R-390] Identify R-390A caps

Thank you for the help on the infamous BlackBeauty, I am doomed. My receiver is full of the things. Any thing that follows is in now way to imply any thing against Orange Drops. Those things are like marines. If you must absolutely stake your life on it you need them. Accept no substitutes. I'm not sure you have to go the full 600 volt route. Orange Drops come in 100 volt styles also. Many caps are cathode bypass with only a few volts on them. To be rated at B+ implies you expect to have a tube short out and you do not want any thing else fried. (IE it will stand there and take it.)

You may accept 100 volt Orange Drops in some of these lower operating voltage places. These would pop if over voltage is applied but are not likely to flame. Other brands of caps of good quality are available in 300 and 400 volt ranges. Some places need the full monty (B+ isolation from the mechanical filters). Having done the kit, I expect that deck to out live your grand children. Even if you are too young to have a drivers license today. Between the full set of 600 volt Orange Drops and doing nothing is a wide range or other solutions that fit less tightly. Besides, Now that its done, why are you ever going to look under that deck again? Roger,

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Date: Mon, 10 Apr 2000 13:48:45 -0500
From: "Dr. Gerald N. Johnson" <geraldj@ames.net>
Subject: Re: [R-390] Identify R-390A caps

I can see going down to 400 volt caps, maybe 200 volt on the AGC, but if the mute switch or the RF gain lets the cathodes rise they may reach screen voltage, so a 100 volt bypass may be overstressed. One thing about Orange Drops is that they leak so little at full rated voltage, they may not need a large safety factor.

The question of orange drop polarity has been posed. Both Orange Drops and black beauties have a ring marking the outside foil of the capacitor assembly. I learned, probably from my father at his knee (when I was not much over knee high), that the outside foil should be the grounded side of a bypass capacitor or the plate side of a coupling capacitor. That way the outside foil shields the bypass capacitor from becoming an antenna and the low impedance side of a coupling situation shields the following grid from external influences. I see reports that the original capacitors in some 390(a) have been installed reversed. This, in my opinion, might be the source of oscillating stages where the stage oscillates at some high

frequency. The inverted capacitor has inherent inductance, that make its a poorer bypass at HF and VHF frequencies and then that outside foil can act as an antenna to radiate RF from the screen back to the grid to lead to regeneration.

My older Sprague capacitor catalogs mention that outer foil identification mark but say nothing about the need for it to be the grounded end of a bypass capacitor. I've scanned the capacitor section of Radiotron, Gerhardi, an older ITT handbook, Electronic Engineer's Handbook, MIT RADLAB Components handbook, MIT RADLAB Microwave receivers, a book on fixed and variable capacitors, a commercial radio operator's handbook and so far have found no comments about paper capacitor polarity. I do not recall ever seeing a TV or BC radio with the outside foil connected to the screen or cathode, all I remember were with the outside foil grounded.

Date: Tue, 11 Apr 2000 01:32:26 -0400
From: km1h@juno.com
Subject: Re: [R-390] Identify R-390A caps

> I can see going down to 400 volt caps, maybe 200 volt on the AGC, but
> if the mute switch or the RF gain lets the cathodes rise they may reach
> screen voltage,..... Not likely.....

So a 100 volt bypass may be overstressed. One thing about Orange Drops is that they leak so little at full rated voltage, they may not need a large safety factor. Disc ceramic posibly leak less over time. Orange Drops are useful in circuits with a high AC component and other applications where dielectric heating is an issue. In a 390xx....waste of money

> The question of orange drop polarity has been posed. Both orange
> drops and black beauties have a ring marking the outside foil of the capacitor assembly.

Just about any old paper cap has the same band or a ground notation on the outer cylinder. Well, at the knee of my mentors at National Radio that subject came up. I was told that it was primarly to shield audio bypass stages from AC fields in 30's era radios AND to reduce the possibility of oscillation in the IF stages. I was also told that it made no difference in modern radios (modern being when miniature tubes are used) since the stability was built in to the tubes. Dunno...thats just what I was told by EE's who were products of the early 30's.
I STILL follow the band as I have have been bit in the past when recapping 30's era radios with foil type caps..its just habit now. OTOH I've never had an oscillation problem when using disc ceramic, even in very early auto radios that were originally known for the "squeals". Several

early Nationals were actually critical to the foil bypass lead length and point of ground. We have certainly come a long way!

Date: Tue, 11 Apr 2000 01:02:55 -0400
From: km1h@juno.com
Subject: Re: [R-390] Identify R-390A caps

WHY? With B+ running well under 300V a 400V cap will last just as long and if its one of those Orange Drops take up less room. In the grid and similar LV circuits a 50V disc ceramic will not reduce the reliability. There is absolutely no reason why a rebuilder cant just go to Mouser and buy the values needed in disc ceramic and be done with it.

He will certainly save a bunch of money at no loss in reliability or performance. A side benefit is now having enough room in some modules to get in and check other parts. Take a minute and look at the original caps, 300 and 400V were predominant. They were paper no less and somehow managed to survive 30-40 years.

Date: Tue, 11 Apr 2000 09:15:57 -0500
From: "Scott, Barry (Clyde B)" <cbscott@ingr.com>
Subject: RE: [R-390] Recapping R-390A

Looked in the Mouser catalog and noticed the length and lead spacing for 400V and 600V 0.1mfd ODs are the same. The only difference is the diameter 0.75 vs 0.60. Not that much space saving between the two after all.

Date: Tue, 11 Apr 2000 08:54:17 -0500
From: "Dr. Gerald N. Johnson" <geraldj@ames.net>
Subject: Re: [R-390] Identify R-390A caps

My dad did have a shop in the 30s servicing Zenith radios in Perryville Missouri. It was in the furniture store that sold Zenith. He didn't stay in business very long, the other store in town sold Philco that used fewer tubes (a reflex design) for a significantly lower price and had their own repair shop. He moved on to something else figuring eating was a needed result of the business. He resumed a part time shop during WW2. Then built a house and I started part time in about 1955. Up through 1963 I paid a significant portion of my college tuition fixing radios and TV. I've tried to devote my bench space to inventing and ham projects ever since, though right now I've a need to fix my own stuff.

Early auto radios were packed tightly at times. Disc ceramic caps do make for poorer antennae than inverted paper capacitors because the disks are smaller and the stray inductance of the capacitor is smaller.

On the other hand the inductive paper may be a more effective bypass at 455 KHz by being close to series resonance. "Modern" tubes have far shorter internal leads to the base than the 30's 4, 5, and 6 pin tubes and so make bypass capacitors far more effective. And IF tubes often include shields between the elements and leads, even sometimes a metal disk at the middle of the base press, and a shield around the tube works inside the glass. That's not the plate of a 6BA6 you see, that's the shield.

Date: Tue, 11 Apr 2000 17:36:20 -0400
From: "Randall C. Stout" <rcs1@sprintmail.com>
Subject: [R-390] C553 adventure

I pulled the IF deck on my Collins blue striper to replace C553. The orginal vitamin Q was rather yellowed and grungy looking, and in a different location(placement) then I have seen in any of the manuals. The connection was correct, just the placement. Anyway, removed it, pushed the ceramic caps around gently, formed the leads on orange drop, insulated the leads with 3M heat shrink tubing(rated for 500v), carefully soldered in, double checked for no touching leads, solder orphans, etc, and popped it back in. Imagine my dismay when I had a dead radio. Well, not truly dead, but I could only hear a few very strong stations. I don't have meters in it yet, so pulled a EAC deck out that I knew worked, slapped it in, and had exactly the same response! Well, I felt a little better, but that didn't fix the radio. I noticed that turning the local gain control made no difference in the volume of the few stations I could hear. I checked the 5814a in V602, deader than a doornail. It had been checked just a few days earlier, and was fine, and was working fine when I pulled the IF deck. So, the question is, how could my efforts to redo C553 have killed V602, or was it just pure coincidence? I put the Collins IF deck in a different rig, and it worked like a champ. Thoughts?

Date: Tue, 11 Apr 2000 17:40:04 -0400
From: "Randall C. Stout" <rcs1@sprintmail.com>
Subject: [R-390] lead shaping ?

In my previous posting I mentioned replacing C553. It took a bit of work to bend the leads to fit it in the corner ala Chuck. I tried to be very gentle, support the lead where it went into the cap, etc, but was bothered by the fine nicks that all the bending put in the leads. I tried both serrated and non serrated pliers. Is there a secret to do this without nicks? I have seen pliers with round jaws(cross section) which look like they might help form leads. Do they work?

Date: Tue, 11 Apr 2000 18:39:24 -0400
From: Barry Hauser <barry@hausernet.com>

Subject: RE: [R-390] Recapping R-390A

I don't want to set off a holy war, but ... The favorite traditional replacement seems to be Orange Drops. Others have said the yellow polyesters and polystyrenes are good, just be careful with the soldering iron so as not to melt 'em. However, I now have it on authority that you can replace any paper tubular cap with a disk ceramic. Are them fightin' words? Just give me a minute to get the bunker door closed... Anonymous (please ignore the email "to address" -- nobody here but us chickens)

Date: Tue, 11 Apr 2000 18:55:39 -0400
From: antipode <antipode@ne.mediaone.net>
Subject: Re: [R-390] Recapping R-390A

On the subject of the capacitors, I've noticed in the specs that one series of the "Orange Drop" capacitors has copper-plated steel leads, while another series uses pure copper. Now don't worry, I'm not going to try to debate the merits of copper vs. steel in this application from an electrical standpoint, however in the past I've stayed away from components where possible using the steel leads as they are harder to form than the copper ones. This also IMHO can cause mechanical stress on a terminal as the lead tends to be stiffer and essentially "loads" the terminal with a constant force similar to a spring if it's not formed exactly right. This can be particularly troublesome in a tight space.

Date: Tue, 11 Apr 2000 19:27:12 -0500
From: "Dr. Gerald N. Johnson" <geraldj@ames.net>
Subject: Re: [R-390] Recapping R-390A

I like the Orange Drops because I've abused a few and they still are super capacitors. There may be other makers with similar quality but I've not tested them the same ways. And Orange Drops are readily available, more than from many other domestic makers. Sure you can replace SOME paper capacitors with disk ceramic but you have to face some consequences. 0.1 at 400 volts is a value I've never seen in a disk ceramic. Plus the very large values in disk ceramics have a very high temperature coefficient of capacitance, negative. I've found them to lose as much as 85% of their room temperature value being close to the base of a tube. Further they have low inductance which is generally good, except that ordinary paper capacitors can be close to series resonance at 455 KHz and actually show a lower impedance in the bypass than the same capacitance (neglecting the effects of heat) in a disk ceramic. At MF and HF frequencies there's no doubt that disk ceramics make better bypasses than paper, providing they are kept cool. Large value disk ceramics are thin but large in diameter which gives them a different packing problem. While the temperature coefficient of the mylar capacitor isn't really stable its more stable than a

large disk ceramic and in the bypass situation should make the alignment and frequency stability of the radio less dependent on temperature than using wandering disk ceramics.

Date: Tue, 11 Apr 2000 19:27:21 -0500
From: "Dr. Gerald N. Johnson" <geraldj@ames.net>
Subject: Re: [R-390] Replacing Caps

Sometimes you can substitute, sometimes you can't. Within voltage ratings, most of the time dipped solid tantalums are superior replacements for aluminum electrolytics. But when I did that to capacitors around an audio output stage in a Heathkit SB-110A, I created a monster. The greater bandwidth of the tantalums caused the audio stage to oscillate at a few hundred KHz (for noise limiting there were capacitors on the cathode and grid...). Miniature aluminum electrolytics tend to be poor when new and to have short lives. They need replacement way before black beauties. Some fail my power factor tests fresh from the store. Circuits with paper are improved when replaced by mylars of the same construction. It would not necessarily be an improvement to use an extended foil mylar to replace a plain paper because the inductance inherent in the ordinary paper would be reduced and the IF range series resonance would not be present. So it would require a larger value of capacitance to reach the same overall impedance. Same thing that happens with a disk ceramic. But the extended foil would make a better bypass capacitor at high frequencies. Molded micas are generally improved when replaced by dipped silver mica capacitors. Though some production runs of dipped silver mica capacitors have proven to have rotten stability because of air bubbles in the coating. Disk ceramics are best replaced by similar sized disk ceramics. If a replacement is significantly smaller, the temperature stability of the replacement is likely far poorer than the original. The more compact the ceramic, the greater the dielectric constant and the temperature coefficient of capacitance, and the piezo properties. Ah, yes the most common high dielectric constant ceramic is strongly piezo electric so with lots of voltage applied, can lead to voltage effects on capacitance and can speak if the voltage is AC. That ceramic is barium titanate. It also can create voltages from physical pressure. Temperature compensating ceramics (flat in Collins PTOs, tubular in other products, disk ceramics in some modern equipment) need to be replaced with the same capacitors to prevent changing frequency drift properties. E.g. N750 for N750, NPO for NPO, N220 for N220, P080 for P080. NPO is the least stable of the family. Temperature compensating capacitors are not normal distributor items these days and so are very hard to find. Don't break them by accident! I did find a cache of Collins PTO temperature compensating capacitors last summer but I've not yet organized them to see what values I do have and am not ready to become a mail order parts store.

Date: Wed, 12 Apr 2000 08:50:39 -0500
From: "Dr. Gerald N. Johnson" <geraldj@ames.net>
Subject: Re: [R-390] Identify R-390A caps

According to the SB electronics page, the type 715P capacitors are extended foil so are very low inductance and that makes the outside foil marker insignificant. And makes my argument for series resonant IF bypassing a waste of warm air. Might as well use disk ceramics except for their outrageous temperature sensitivity and piezo electric effects.

Date: Wed, 12 Apr 2000 11:43:07 -0500
From: "Dr. Gerald N. Johnson" <geraldj@ames.net>
Subject: Re: [R-390] Identify R-390A caps

It looks like all that SB Sprague makes is extended foil and thus low inductance capacitors where the outside foil mark isn't significant. So they don't mark. I did some digging in my collection and the only OD with an outside foil mark was a 220P, not of recent construction. I found some large Orange Drops with out outside foil marks that I've have probably 20 or more years so its not necessarily something new. OD's probably should be used for tuning capacitors, though the polypropylene specification claims they are suitable replacements for polystyrene with equivalent stability and precision. I prefer silver mica capacitors for RF and IF tuned circuits.

Date: Wed, 12 Apr 2000 14:27:16 -0400
From: "Jeff Adams" <jadams@mcqassociates.com>
Subject: Re: [R-390] Identify R-390A caps

Dont forget though that the Poly's (polystyrene and polypropylene and polyester) are VERY easily damaged by heat (by both circuitry and soldering irons). I don't have Sinclair's book in front of me but I remember that some of these were speced to only 130-140 F! Be careful contemplating the usage of these in boatnchors around heat generating circuits... Silver Micas are expensive, but GREAT in these applications. I like the Silver Micas alot, the only concern is cost. They are temperature stable and are highly accurate to boot...

Date: Wed, 12 Apr 2000 20:08:16 -0400
From: eengineer <eengineer@erols.com>
Subject: Re: [R-390] Identify R-390A caps

Yep. Here are a few words for you capacitor guys out there: From "Troubleshooting Analog Circuits EDN Series for Design Engineers", by Robert A. Pease

"Often a designer installs a polyester capacitor (technically, **polyethylene** terephthalate, often called **Mylar** - a trademark of E. I. Dupont de Nemours and Co.) and wonders why something in the circuit is drifting 2 or 3% as the circuit warms up. What's drifting is probably the polyester capacitor, its TC of 600 to 900 PPM per degree C is 10 times as high as that of a metal-film resistor."

"Be careful with **polystyrene;** its maximum temperature is +85 Degrees C, so you might damage it during ordinary wave-soldering unless you take special precautions to keep the capacitors from over-heating."

"Silvered-mica capacitors have many features similar to COG capacitors. They have low ESR and a TC of 0 to +100 PPM per Degree C. They can also work at temperatures above 200 Degrees C if assembled w/ high temperature solder. Unfortunately, they have poor soakage characteristics - unexpectedly bad dielectric absorption."

{back to me}
Dont forget about the problem of having one of those polystyrene's next to a hot tube or shield. That could be the death of it. That's why I like **Orange Drops and silver micas** so much.

Date: Thu, 13 Apr 2000 02:21:29 -0400
From: km1h@juno.com
Subject: Re: [R-390] Recapping R-390A

ANY is too strong a statement Barry. Discs can replace MANY paper caps as long as you understand the gotchas. I would NOT use generic catalog discs in AC circuits, DC circuits with a large AC component (big audio amps) or any RF circuits above receiver level power. There are discs made that work absolutely fine at the above applications but they are specialized construction and cost more. I use 0.01 discs as vibrator buffers in auto radios but they are buffer rated. The same holds true with AC line bypasses; use only those with AC ratings along with UL/CSA/VDE, etc listings.

As far as discs not doing a good job as IF stage bypasses...thats pure BS. (Where octal and later tubes are concerned). Discs were not used in many applications until the late 50's or so since they actually cost more then and trying to get high value plus high voltage was a process problem. If you doubt their acceptability, look at any of the quality radios of the roughly early 60's until the end of the tube era. Disc was the choice of Collins, Drake, you name it.. No one "tuned " their bypasses for series resonance...just more hogwash. Actually discs became MORE in vogue as radio size shrunk, especially the advent of ham transceivers. Tighter

packing, with the accompanying heat, caused no problems for discs, contrary to what some would have you believe. Paper caps in those confines...".FORGETABOUTIT." We would still be living in the dark ages.

For those with a modicum of experience past their 390xx look at say a National NCX-5, Swan or Drake xcvr. Absolutely packed tight with parts, yet 35 years later restorers have just about zero problems with any of the disc caps. Paper caps....zero used.

Does that tell you something? Am I getting thru or do I need a 2x4 to get a few of y'all's attention? Beside throwing away money OD's are just plain ugly in a military radio. Every time I see one of those new orange VW Beetles I have the urge to paint a black band on the rear!

Shutters are closed and the muzzle loaders are primed.

Date: Fri, 21 Apr 2000 09:57:15 -0500
From: "Scott, Barry (Clyde B)" <cbscott@ingr.com>
Subject: [R-390] C609

Can someone tell me why C609 is/was an electrolytic? Is it because the only way to get that large a value in that small a package is for it to be constructed with electrolytic technology? If it were possible to find an 8ufd paper cap that would fit, it would work just as well, correct? There's nothing magic about an electrolytic in this application, right?

Date: Fri, 21 Apr 2000 11:57:37 -0400
From: km1h@juno.com
Subject: Re: [R-390] C609

.....because the only way to get that large a value in that small a package is for it to be constructed with electrolytic technology?

Correct.

> If it were possible to find an 8ufd paper cap that would fit, it would work just as well, correct?

Yep and be about the size of the output xfmr.

> There's nothing magic about an electrolytic in this application, right?

Nope and neither is the value sacred. A commonly available 10MF will do just fine.

Date: Fri, 21 Apr 2000 10:20:43 -0500

From: "Dr. Gerald N. Johnson" <geraldj@ames.net>
Subject: Re: [R-390] C609

Electrolytics tend to be the poorest for quality but the most compact for C per unit volume. Trouble is the wet electrolytics (especially tantalum) eat through their cases and sometimes the adjacent components. The modern dry solid tantalum is a much better capacitor than the wet tantalum.

Date: Fri, 21 Apr 2000 11:36:55 -0500
From: Randy & Sherry Guttery <comcents@mississippi.net>
Subject: Re: [R-390] C609

Right - an 8ufd paper (mylar, poly, etc.) would be HUGE. Since the most voltage that might be seen across C609 would be less than 6 volts - (V601 shorted plate to cathode) then a modern 10ufd 10V axial electrolytic would do just fine - and could be hidden inside of black heat shrink so it's "modern appearance" wouldn't be obvious there on the terminal board.

Date: Fri, 21 Apr 2000 13:34:28 -0500
From: "Scott, Barry (Clyde B)" <cbscott@ingr.com>
Subject: RE: [R-390] C609

Rats. I was just in the local parts store and ran across some 8ufd @ 25V with axial leads (looked very much like the VitQ caps) that would've fit very nicely, but I didn't buy them as I thought the voltage rating might be borderline insufficient. I've seen 35V as the recommended value. Oh well, I have a 8ufd @ 35V tantalum that I'm going to use. These just had the original look-n-feel.

Date: Fri, 21 Apr 2000 17:04:14 -0400
From: km1h@juno.com
Subject: Re: [R-390] C609

It may help to obtain an ARRL Handbook or similar publication that addresses many of your basic questions. Capacitor values and voltages are a continuing issue that may be best answered in an established reference. The tube era Handbooks are a great resource.

Date: Fri, 21 Apr 2000 23:35:27 -0400
From: "Walter Wilson" <wewilson@knology.net>
Subject: Re: [R-390] To recap or not to recap

I gather you checked the values, but did you check for leakage (measure the leakage current) ? I replaced ALL the paper caps in my R-390A, and it made a big difference. I did not have a cap checker at the time, so just replaced all the paper ones, plus the mica cap in the RF deck that Chuck

Rippel recommends.

I would ALWAYS replace the one that protects the mechanical filters, followed by the electrolytic caps on the AF deck (in the cans). Mass replacement of the rest is open for debate, but I say get all the paper ones and the wet tantalum (8uF) in the AF board. Replace it with a 8 to 10 uF dry tantalum. Just my opinion. Like you said, working on radios is therapy. I don't know if I'll be as thorough on other R-390As, but this one was my first one, and I wanted it to be the best it can be. Pictures of all the new caps at my website. I personally like the color orange. \;^) BTW, a good number of my paper caps (brown tubular type in my radio) had cracks along the mold line upon close inspection.

Date: Sat, 22 Apr 2000 00:56:16 -0700
From: "Gene G. Beckwith" <jtone@sssnet.com>
Subject: Re: [R-390] To recap or not to recap

My recommendation is to do the re-cap...it is essential preventitive maintenance, and in some cases may save u untold head aches and raw nerves later on... especially in the case of main power supply electrolytics and the nasty little one the may leak and chew up the board the components are mounted on. Doing the audio deck is the easier tasks of the several, and you will be a happier person and for it and rest easy knowing your big "Pet" is easying along with mimimum chance of destroying other hard to replace components later on... Go for it and don't look back...I just finished an audio board...with the electrolytics (actually power supply caps) being of absolute top priority. By the way, the foil on the board is delicate to the extent that with too much heat, it may detach itself from the board...if this happens, don't be dismayed... or waste good soldering time! Just gently glued it back down to the board with a bit of "supper-glue"...its common on the boards I've worked on...

Date: Sat, 22 Apr 2000 10:26 -0700 (PDT)
From: rlruszkowski@west.raytheon.com
Subject: Re:[R-390] To recap or not to recap

I offer that you change them. The results for any one is not great. But once you get them all changed the difference is lower receiver noise. Thus more signals heard less than 1 DB above that lower noise level. Bad things can really be trouble some. should we keep a fire extinguisher on hand, or not let the children play with matches (bic lighters).

Date: Thu, 27 Apr 2000 16:50:43 -0400 (EDT)
From: Norman Ryan <nryan@duke.edu>
Subject: Re: [R-390] Where is C612?

> Ok, I took the sage advice of the group, and having purchased a complete
> cap set (thanks to the list member who provides this service), proceeded
> to do the job. Well, I replaced all the caps on the board and only
> lifted one trace. Then I removed C601 to get to the mica cap below it.
> Not every having read the value of a mica cap, I looked at the schematic
> for the value. Lo and behold, I can't find the cap on the schematic. I
> can find R601, the resistor that it parallels from pin 2 of VX601 to pin
> 14 of J620, but no cap. Page 77 of the manual shows a pictorial and the
> cap is there, C612. I assume that the schematic is incorrect? or did I just miss the cap?
> Also, I read (first time in my life) the value of C612 as 68k. Is this
> correct, and what type of cap should I replace it with?

You're right, C612 is missing from the R-390A schematic, but appears in the photograph in TM 11-5820-358-35. C612 was added later and appears on the modification list somewhere. That's what "See Note 8" on the schematic refers to. The value is 68 picoFarad, not 68K, and can be replaced with a dipped silver mica cap. Go ahead and pencil in C612 on your schematic. It is wired in parallel with R601.

Date: Tue, 9 May 2000 13:32:55 -0500
From: "Scott, Barry (Clyde B)" <cbscott@ingr.com>
Subject: [R-390] 0.005mf caps

Anyone have a source for 0.005mf, 1kV, ceramic disk caps? I located some at a local supply house, but they are 1.6kV. I haven't seen them, but they are supposedly the same size as the 1kV caps and, if so, they will be okay. However, if they are larger, I would like to get some 1kV caps the same size as the original ones. I've overkilled with the 600V OD caps and I don't want to keep filling up the cavities with oversized components if I can help it. Mouser and Antique Electronic Supply don't seem to have them.

Date: Tue, 09 May 2000 13:26:08 -0500
From: "Dr. Gerald N. Johnson" <geraldj@ames.net>
Subject: Re: [R-390] 0.005mf caps

Mouser 539-GP247 4700 pf, 1KV +/-20% Close enough to .005... 32 cents each, unless you buy them by the 100, then they are 16 cents. each.

Date: Tue, 9 May 2000 14:36:20 -0500
From: "Scott, Barry (Clyde B)" <cbscott@ingr.com>
Subject: RE: [R-390] 0.005mf caps

I saw those and wondered about them. Of course I'd prefer the exact value (realizing they're +/- anyway), but if that's not possible, then I'll go with

what I can find. Seems they have 5600pf as well. I suppose since 4700pf is closer to 5000pf, it's the better choice, but I thought it may be that 5600pf may be a better choice for the function they provide. Probably not spit difference, but I thought someone might comment.

Date: Tue, 9 May 2000 16:30:44 -0400
From: "JM/CO" <jmerritt2@capecod.net>
Subject: Re: [R-390] 0.005mf caps

The standard values have changed since the days of R-390s. 5000 PF is no longer a standard value (as is anything else "5") 4700 is what you want. Chuck N1LNH

Date: Tue, 9 May 2000 16:56:58 -0400
From: km1h@juno.com
Subject: Re: [R-390] 0.005mf caps

Dunno what you have been reading or smoking. BTW, stick to 500V or so just to give a bit of room to find other problems. If you still find catalog manuvering a chore I have a few thousand here.

Date: Tue, 09 May 2000 20:12:39 -0500
From: "Dr. Gerald N. Johnson" <geraldj@ames.net>
Subject: Re: [R-390] 0.005mf caps

When the part changes value by 50% when voltage is applied or the part is heated or cooled from room temperature, a 6% discrepancy in labeled value (at least 10% calibration tolerance, likely 20% calibration tolerance) has little significance. There was a revealing chart in an article on capacitors in the latest Microwave Journal that showed the effect of voltage and temperature on a standard general purpose ceramic composition. I should scan that chart to show why I don't expect precision or stability from ordinary ceramic capacitors.

Date: Wed, 10 May 2000 08:59:54 -0500
From: "Dr. Gerald N. Johnson" <geraldj@ames.net>
Subject: Re: [R-390] 0.005mf caps

I am partial to dipped silver micas in frequency determining circuits, like oscillators and tuned coils. I see Mouser has .0047 50 volt dipped silver micas. $3.48 each! About the size of a .01 @ 400 volt 715P series orange drop. Not quite capable of fitting the same space as the disk. In a disk you'd prefer an X7R or Y5P temperature coefficient, you'd dislike a Y5U, Z4V, and Y5V, Dig-Key shows curves for these in their latest catalogs.

Unfortunately a .0047 500 volt capacitor is probably only going to be

available in the wild temperature coefficients because the more stable dielectrics have lower dielectric constants and the capacitor would be too big to fit in the space the original capacitor was. Which leads me to believe the original had the large temperature coefficient, so a .001 temperature stable capacitor might serve as well.

Unless a disk ceramic is running hot or changing the voltage on a circuit from leakage, there's no need to shotgun replacing it. The failure rate of disk ceramics is far lower than that of the black beauties, and doesn't justify wholesale replacement. Which is NOT to say that they never fail, but almost. Whereas experience with black beauties and their contemporaries indicates a near 100% failure rate.

Actually the modern extended foil type of Orange Drops supplied by the current Sprague division are probably nearly as low inductance as the disc, but not as compact. And the polyester films have decent temperature coefficients for everything but tuned circuits.

Date: Thu, 18 May 2000 09:07:01 -0500
From: "Dr. Gerald N. Johnson" <geraldj@ames.net>
Subject: [R-390] Re: Capacitor question

> Jerry, I recall you often performed a brute force leakage test on capacitors

I rarely detect leakage in new capacitors with my tough test. I discard old caps that show more than 1 volt across 11 megohms. That's 91 nano amps. Insulation resistance of 4,950 Megohms with 450 volts applied. Most old paper caps miss that by miles showing only a few megohms insulation resistance when that high.

Date: Thu, 18 May 2000 15:37:05 -0400
From: Roy Morgan <roy.morgan@nist.gov>
Subject: Re:[R-390] Re: Capacitor question

>Once more: how do we set up to do this test?

Capacitor leakage testing

1) Find a B+ supply that will deliver a voltage as high or higher than the capacitors rated working value. A variable supply is nice but not necessary. Current capacity is not important - a few milliamperes is fine.

2) Get a VTVM or a DVM with high input impedance (10 megohms is common).

3) Set the voltmeter to measure volts on a range above the supply voltage. Connect the common terminal of the supply to the common terminal of the voltmeter.

4) With the supply off for safety, connect the capacitor from the high side of the supply to the high side of the voltmeter.

5) Turn on the supply.

6) Observe the meter.

The meter's input resistance causes it to operate as very sensitive microammeter. 10 volts across 10 megohms indicates a current of one microampere. One volt = one tenth μA, or 100 nano-amperes.

Example: with a supply voltage of 350 volts and voltmeter indication of 50 volts, the capacitor is conducting a current of 50 microamperes. The capacitor has an impressed voltage of 300 volts (350 minus 50). You can figure the capacitor leakage resistance by Ohm's law, or by proportions. Note, it has 6 times the voltage as the voltmeter, so it has 6 times the resistance, or 60 megohms. In my experience, it is common for old paper capacitors to measure one quarter to three quarters of the supply voltage in this setup. It is also common for modern film capacitors to measure less than a few tenths of a volt.

Consider the case of an old paper .01 uF capacitor feeding the audio output tube in a receiver. The preceding stage operates at a plate voltage of 200 volts. The old paper capacitor leaks about 100 microamperes. The output tube grid resistor is 100Kohms. The voltage developed across the grid resistor from the leakage is 10 volts. This 10 volts reduces the grid-cathode bias on the audio out put tube from -minus 14 volts to minus 4 volts. In the case of a 6V6, or 6AQ5, that will increase the standing plate current from a normal 25 or 30 ma to about 80 or 100 ma. The audio will sound terrible and the tube will last only a few hours instead of a few thousand hours.

Leakage in the blocking cap at the audio pre-amp stage is even more damaging to the sound since the stage operates at lower bias levels.

Consider the case of a screen bypass capacitor in a receiver IF stage. The B+ supply is 220 volts, normal screen current is 5 ma, screen resistor is 22K, and screen voltage is about 110 volts. The tube operates with normal gain. Now, if the screen bypass cap leaks 3 millamps, the screen voltage will go down to something like 60 volts. The tube will operate a lower gain, will not respond in the same way to AGC voltage, and will be more subject to overload on strong signals. If many IF and RF stages are

having similar screen bypass leakage problems, your radio will be quite dead.

I have a number of as-yet un-re-capped receivers like this. You can measure screen bypass and grid coupling capacitors in circuit by pulling out one or more tubes and measuring voltages on either side of the cap. Take into account the voltmeter input resistance and any resistance to ground on the non-B+ side of the cap, such as the grid resistor. You can do this withOUT removing any modules form the chassis in the R-390. Count your tube pin numbers in the right direction when working from the top of the chassis.

Note: Many older radios were measured with 1000 ohms-per-volt meters and the reported normal tube voltages reflect this. Most affected are screen voltage and voltages in high resistance circuits. Notable examples are the TV-7 tube tester and most pre-war receivers. Your TV-7 will not be calibrated right if you do it with a modern 10-megohm input resistance meter. Just add a resistor in parallel with the meter appropriate to the scale you are using.

Date: Thu, 18 May 2000 16:13:59 -0400
From: Roy Morgan <roy.morgan@nist.gov>
Subject: Re:[R-390] Re: Capacitor question "pico" => "nano"

Correction: I wrote in error: "One volt = one tenth microampere, or 100 picoamperes." One volt in 10 megohms is 100 NANOamperes (not 100 picoamperes.)

Date: Tue, 06 Jun 2000 22:45:02 -0500
From: "Dr. Gerald N. Johnson" <geraldj@ames.net>
Subject: Re: [R-390] 2 questions from a new user

> .....I check the 2 uF oil filled AGC cap for leakage, and if bad, leave it in
> place but disconnect it and solder a 2.2 uF electrolytic replacement under the IF deck.....

All those paper and electrolytic replacements are worth while but an electrolytic replacement for the AGC capacitor is about the worst possible choice... An electrolytic will leak more than the old oil capacitor. A 2 uf 200 volt orange drop would be a far superior replacement. Unless your leakage check is up to showing 100s of megohms, figure on that capacitor being leaky enough to affect AGC.

Date: Tue, 06 Jun 2000 22:47:06 -0500
From: Nolan Lee <nlee@gs.verio.net>

Subject: RE: [R-390] 2 questions from a new user

>I thought the metal-cased Vitamin-Q caps were the ones to get rid of, and
>that the yellow-waxy ones held up better. Now, I hear the opposite.

Change ALL of the paper caps, period. It's cheap insurance. Undoubtedly someone will tell you otherwise. I've listened to people bitch and moan about the amount of effort it takes sine I first brought up the idea back in late 1998 but it's well worth doing.

"Ooh, it's too hard and I might burn my little fingers or break a nail."
"I'll miss Star Trek tonight..."
"Whine whine, I've got a hot date with a pair of Swedish nympho twins".
"My dog chewed the cord off of the soldering iron."
"The voices in my head said not to."
"Those caps have worked fine for the last 45 years, why?"
"If it ain't broke, don't mess with it."

Yeah, right. Who needs Gatling guns, we can travel faster without them....

I've listened to dozens of reasons why there is no need to change them and it's a wasted effort, etc. I still think that for the person that actually uses their radio and doesn't have it as a trophy sitting on a table somewhere where they stare at it while they drink some sissy drink like lite beer or some twisted version of coffee that doesn't even contain chickory, and intend to keep the radios for the duration, should put forth the effort and change the caps.

Yep, it's takes time, and the IF deck is a pain in the ass. I'd guess that doing nothing but changing the paper caps themselves in the radio will easily eat up 15 or 20 hours if you take your time and are very careful and cautious. You end up spending more time than that because while you have the beast apart, you'll want to check the value of all of the carbon composition resistors and replace the ones that are out of spec. Cut up a beer can with a pair of scissors and make yourself some assorted sized of soldering shields to protect the wiring harness, etc while you're soldering. Pick up three of four hemostats for heat sinks, to clamp to the leads of any carbon composition resistors that happen to share a common solder connection with some of the caps you'll change. This decreases the change of changing their values up out of spec. It takes effort, but that's nothing compared to spending days or weeks tracking down little quirky AGC problem and a host of other problems that over time, I can almost guarantee you 100% that you will have with those 35 to 45 year old paper caps.

>Are the yellow waxy caps really that bad? If so, I have a lot of soldering

ahead of me...

They aren't anywhere near as bad as the old brown tubular caps, but we're still talking about 30+ year old paper capacitors. ;-(Do one module at a time. Pull the RF deck for a good cleaning, and mechanical alignment. While it's out, change the three axial leaded paper caps and test the hell out of the stud mounted one next to the 6DC6. If it's less than perfect, change it. It's seldom that if fails but test it while you have easy access to it. As a rule the oil filled paper caps are probably the most reliable paper caps made. I've got some here that are pre WWII and they are perfect. The next time you fell energetic, pull the AF deck and replace the caps under it, they're a snap. Also replace the axial leaded tantalum while you're in there. Save the pain in the ass IF deck for last. You can knock it out in a couple of two or three evenings of "casual" work.

Remove the BFO osc can and the long shaft for the bandwidth switch and it makes the job much easier. Be very careful with the insulated posts that some of the caps attach to. Too much heat for two long of a period of time and they break very easily. Replace the caps in a logical order and try to duplicate their positions and routing of the leads as closely as possible.

I've owned and played with R390A's since the mid 1970's. This last one that I did, I replaced all of the paper caps in and took a lot of steps to make sure that it would be reliable as possible when I was done. As of today, it's been running twenty four hours a day and seven days a week since the overhaul which I finished back on the 13th of October of 1998. A little quick math shows this to be in excess of 14,000 hours. That's 14,000 hours in a an uninsulated masonry building with temperature extremes of below freezing in the Winter and well over 115 degrees during the Summer. Let's not forget the humidity down here in South Louisiana either. It's sitting here running on a Variac at 114 or 115 volts as I type this. The electrical and physical alignments are still solid, the sensitivity is still wonderful, and other than changing out a few tubes a while back, nothing has been done to it in this time period. I have never had an R390A give this level of reliability even back in the 1970's when the radios were twenty five years newer than they are today. That's not saying that it won't try to burn the shop down tonight while I'm sleeping or try to electrocute me the next time I go to adjust the volume or something, but I kind of doubt it.

Date: Tue, 6 Jun 2000 20:58:19 -0400 (EDT)
From: Norman Ryan <nryan@duke.edu>
Subject: RE: [R-390] 2 questions from a new user

Bottom line is you shouldn't trust any vintage paper cap, no matter what it's encased in. They always leak to some extent and worsen over time.

Cool thing about the Orange Drops is you can put a charge on them one day and see a spark when you short the leads the next day. I think that's pretty phenomenal. Yep, there are a lot of caps in the set, especially the IF deck.

Don't despair when you pull the RF deck, though. It only has three paper type capacitors. But you'll check the carbon composition resistors while you're in there, right? :-)

Date: Wed, 07 Jun 2000 10:17:46 -0400
From: Roy Morgan <roy.morgan@nist.gov>
Subject: Re: [R-390] 2 questions from a new user

>.....but disconnect it and solder a 2.2 uF electrolytic (!) replacement under the IF deck.

Is this wise? I would expect that the AGC buss needs a very low leakage cap at that point. A new electrolytic MIGHT be low enough leakage, but will likely cause trouble over time. The circuit operates at 15 volts maximum or thereabouts. I suggest you find a modern made 2 uF film cap of low enough voltage to fit in the space. I have 1 uF 100 volt mylar caps for the purpose - two in parallel do the job.

Date: Wed, 07 Jun 2000 10:29:26 +0000
From: "B.L.Williams" <B.L.WILLIAMS@prodigy.net>
Subject: Re: [R-390] 2 questions from a new user

I'm glad someone else mentioned this technique. After reading about lifting foil I decided to do my recap job like that.

I did a quick resistor replacement on the AF deck this way a few months ago. It would make future cap replacements easier, and lessen the dangers of overheating. Some of those leads are made of heavy duty wire that provide good support and long contact surfaces.

Date: Wed, 07 Jun 2000 11:30:16 -0500
From: "Dr. Gerald N. Johnson" <geraldj@ames.net>
Subject: Re: [R-390] 2 questions from a new user

With any leaky capacitors on the AGC line the symptom is distortion on strong signals due to poor AGC action and the last IF stage being over driven. The leakage can be any combination of leaky capacitors, but my experience with paper capacitors of the vintage of the R-390 is that every last one is leaky so its not worth the bother of checking receiver symptoms or even checking the individual capacitors, just replace them.

And when I mean leaky I mean anything over 0.1 microamp leakage current with rated voltage applied... Orange Drops pass that test. Orange Drops that I bought 30 years ago pass that test...

Waxed and moulded papers do not. Some metal cased oil filled capacitors do, but not many. A
2 µF or 2.2 µF Orange Drop should fit inside the metal case.

Date: Wed, 7 Jun 2000 15:51:29 -0400
From: "Tetrode" <tetrode@sprynet.com>
Subject: [R-390] AGC cap C551 rating - was 2 questions....etc

.....I have 1 uF 100 volt mylar caps .....

I consider a 100 volt rating for C551 too low, as there can be more than just a few negative volts of AGC voltage across it. When the AGC is used in the SLOW position, the "cold" end of that cap is no longer connected to ground but to the plate of the AGC time constant tube V506A, which ties to the B+ line via 82K resistor R549. Thus, when used in this position, the total voltage that the cap will see is the negative AGC voltage plus the plate voltage of V506A. It won't be the full B+ voltage but there will be some of it there during normal operation. And if something funky were to happen like V506 failing, you could have the full B+ applied to that cap if you were using SLOW AGC, and if C551 shorts the B+ will do nasty things to everything connected to the AGC buss. I'd go with a 250 WV rated cap there at least.

Date: Wed, 7 Jun 2000 16:39:05 -0400
From: "Tetrode" <tetrode@sprynet.com>
Subject: [R-390] Quicky C551 leakage check

Here's a quick check to see if a leaky C551 is getting you down. The best way to test it of course is to apply B+ to the cap and measure its leakage current directly but here's one you can do from the comfort of your radio listening chair. With the radio cold, turn it on, let it stabilize for 10 minutes or so, and tune in a calibrator signal. Make a note of the Carrier level meter reading in the FAST mode. Use the reading in the FAST mode as the reference as C551 is out of the circuit in this position. (We will also assume the other two caps in the AGC circuit are good.)

Switch to MED. C551 is now connected from the AGC line to ground. If the carrier meter level drops it is due to C551 leakage.

Switch to SLOW and note the Carrier level again. This is even a better test since the cold end of C551 will now have some B+ voltage on it from the plate of the AGC time constant tube V506A.

Now let the radio warm up real good for a few hours. Repeat the three tests done previously, again using FAST as the reference. Comparing FAST to SLOW will show the largest difference (if there is one).

If there is significant C551 leakage it will be much more apparent now when the radio is hot than before. Capacitor leakage will always increase with temperature.
* * * * * * *
When I did this test with my 390A I could see about 2 dB difference between the FAST and SLOW positions when warmed up. Nothing to get upset about but it does indicate some leakage occurring. Ideally, the carrier level should read the same in all three AGC speeds. When I originally went through my IF deck, I checked C551 out of circuit with 300 VDC applied and measured 0.82 uA of leakage at room temp, which increased to 5.6 uA after I warmed it up good with a heat gun. At the time I didn't have any good substitute caps to put in and I was tackling much bigger problems with the radio, so I just flagged it as something to take care of the next time I take the radio out for a few final touches that are left to do. The toughest part of this test is looking for tiny level differences on the small R-390 carrier level meter. Also, sometimes the movements on these old meters can be a bit sticky. A VTVM with a large instrument meter or DVM connected to the AGC line would indicate AGC voltage differences much better.

Date: Wed, 05 Jul 2000 22:41:20 -0400
From: Al Solway <beral@videotron.ca>
Subject: [R-390] Paper Cap Replacement

Need some advice on the paper caps. I thought that Orange Drops were the capacitor of choice. After reading some of the news group archives it seems that there may be other choices such as any polypropylene film capacitor that has specs similar the the Orange Drop.

I have found one made by Panasonic ECQP(U) and sold by Digi-Key. Their dimensions seem to be more suitable for the R390 application. Am I missing something? I am just a lowly tech with a lot of mileage not an engineer. This is my first attempt at an R390A restoration. So I do need some help.

Date: Wed, 05 Jul 2000 21:41:53 -0500
From: "Dr. Gerald N. Johnson" <geraldj@ames.net>
Subject: Re: [R-390] Paper Cap Replacement

The polyester Orange Drops have 35 or 40 years of history of good performance. The alternatives may be as good, but don't have that long

experience of reliability.

There are some arguments in audio circles about some minor properties of polyester compared to polypropylene, but all the old papers are so much poorer than either that either is a drastic improvement over the black beauties. My experience is with the **polyester Orange Drops**

Date: Thu, 6 Jul 2000 01:23:36 -0400 (EDT)
From: Norman Ryan <nryan@duke.edu>
Subject: Re: [R-390] Paper Cap Replacement

It's true you can use any of the modern plastic film caps such as what you mention. The yellow mylars are OK, but have one major "gotcha" which is that if you touch one with your iron, it will melt. I don't recommend them. (Someone suggested placing shrinkwrap over them in the tighter places.)

Orange Drops or similar such are solidly reliable and very forgiving to install. However, leads usually are of tinned copper plated steel, so be careful bending them around terminals such as on the wafer switches, tube sockets, and especially those terminal posts. They break easily. Overall I'm totally satisfied with them and believe they'll last. Since they leak less than paper caps, ciruits will perform as never before.

While you're in there, replace carbon composition resistors that have drifted (usually upward) more than ten percent. Good luck and have fun!

Date: Thu, 6 Jul 2000 10:33:33 -0400
From: km1h@juno.com
Subject: Re: [R-390] Paper Cap Replacement

You are correct, there sure has been plenty of discussion! I use a combination of ceramic disc, Mylar and Poly of suitable voltage values. Makes for a neater job IMO and easier to get into other areas for troubleshooting. As long as you dont use a 375W gun or 175W iron and use some common sense there shouldnt be any reason to burn the poly (: I've also had several resistors out of tolerance in the IF and Audio modules across several contract suppliers.

Date: Thu, 6 Jul 2000 11:24:50 -0400
From: twleiper@juno.com
Subject: Re: [R-390] Paper Cap Replacement

Why don't one of you enterprising young gentlemen just put together a kit with all the caps and resistors your vast experience says to just replace outright. I'll buy a couple, and I'm sure there'd be more takers.

Date: Thu, 06 Jul 2000 12:08:42 -0400
From: tbigelow@pop.state.vt.us (Todd Bigelow - PS)
Subject: Re: [R-390] Paper Cap Replacement

Already been done by a list member.

Date: Thu, 6 Jul 2000 12:36:30 -0400
From: km1h@juno.com
Subject: Fw: Re: [R-390] Paper Cap Replacement

Doesn't cover resistors which can vary as to need unit to unit. Go to Mouser and you can buy enough caps and resistors for several radios for the same money.

Date: Thu, 6 Jul 2000 13:06:06 -0400 (EDT)
From: Norman Ryan <nryan@duke.edu>
Subject: Re: [R-390] Paper Cap Replacement

Actually, one of the list members has done that very thing with the paper capacitors and electrolytics. To my knowledge, there's no resistor kit, but you wouldn't need to replace every single resistor outright-- just the out of spec ones.

Date: Thu, 06 Jul 2000 11:09:01 -0500
From: "Dr. Gerald N. Johnson" <geraldj@ames.net>
Subject: Re: Fw: Re: [R-390] Paper Cap Replacement

Nolan Lee posts a list of capacitors occasionally. Is probably on his web page.

Date: Thu, 6 Jul 2000 13:18:42 EDT
From: DAVEINBHAM@aol.com
Subject: Re: [R-390] Paper Cap Replacement

Such a kit for the R-390A has been available for several months now. I have 7 kits in stock available for immediate shipping.

Date: Thu, 6 Jul 2000 12:48:34 -0500
From: "Scott, Barry (Clyde B)" <cbscott@ingr.com>
Subject: RE: [R-390] Paper Cap Replacement

Dave, DAVEINBHAM@AOL.COM, already sells a cap replacement kit (I think there may be others). Haven't seen a resistor kit yet, though. Probably because they aren't as reliably faulty as the caps. Some go bad, some don't and they're easy enough to check with an ohm meter. BTW, if

you want a cap kit with electrolytics that will fit inside the original cans, let him know in advance and usually he can supply them.

Date: Thu, 6 Jul 2000 16:39:49 -0400
From: km1h@juno.com
Subject: Re: [R-390] Paper Cap Replacement

Gee, and so are the caps . Why blow a bunch of Pesos when a phone call will save you an embarrasment? I've been thru about 25 radios for people and the parts cost is pretty low unless ur into Orange. Mouser www.mouser.com. Stop wasting money.

Date: Thu, 6 Jul 2000 15:53:40 -0500
From: "Scott, Barry (Clyde B)" <cbscott@ingr.com>
Subject: RE: [R-390] Paper Cap Replacement

You can detect a leaky (not shorted) cap with an ohm meter?

Date: Thu, 6 Jul 2000 17:47:40 -0400
From: twleiper@juno.com
Subject: Re: [R-390] Paper Cap Replacement

> You can detect a leaky (not shorted) cap with an ohm meter?

Of course you can, especially if you take it out of the circuit. A good cap should charge up to infinity in a perfect world, several (or more) megohms otherwise. Your sweaty hands on the leads should leak more, so don't be a clutz.

You may have a cap that breaks down at a higher voltage than your meter projects, so you can set up a simple rig to test them. I use a well filtered 90V dc supply and hook the test cap in series with a 1 meg pot. I measure the voltage across the pot as I sweep it down to 0 ohms. No leak yields no voltage regardless of setting. Use a digital meter like a fluke...something with high impedence. A VTVM would be ideal, especially for a BA guy.

Date: Thu, 06 Jul 2000 16:06:09 -0500
From: "Dr. Gerald N. Johnson" <geraldj@ames.net>
Subject: Re: [R-390] Paper Cap Replacement

No. You can't detect a damaging leaky capacitor with an ohmmeter unless that meter has a 100 megohm scale. The AGC and the audio coupling capacitors can't leak 100 megohms even without causing problems. Don't bother testing the existing paper capacitors, they are leaky. Just replace them. Its faster and saves many months of troubleshooting multiple marginally faulty circuits.

Date: Thu, 06 Jul 2000 16:16:28 -0500
From: "Dr. Gerald N. Johnson" <geraldj@ames.net>
Subject: Re: [R-390] Paper Cap Replacement

I don't think that's a sensitive enough test. What is your leakage voltage limit across the 1 meg resistor? My test uses the input R of a 11 megohm VTVM and fails all capacitors that show more than 1 volt which is 0.09 microamp leakage. Why do you sweep the pot resistance to zero? That's no test. I use the rated voltage of the capacitor or 450 volts (the limit of my bench supply). Remember 1 microamp of leakage (1 volt across 1 megohm) leads to changing the output stage grid bias a half volt.

Date: Thu, 6 Jul 2000 18:29:19 -0400
From: Dennis McLaughlin <dennism2@ix.netcom.com>
Subject: RE: [R-390] Paper Cap Replacement

I used the Panasonic ECQP(U) polypropylene film caps for the IF chassis. They would not fit on the AF chassis. There I used the axial yellow tape wrapped metalized polyester caps from AES. Polypropylene is a better dielectric than polyester. Both are better than paper. Epoxy dipped keeps the moisture out.

Date: Thu, 06 Jul 2000 17:37:07 -0500
From: Nolan Lee <nlee@gs.verio.net>
Subject: [R-390] Paper Caps and Water Pumps...

>You can detect a leaky (not shorted) cap with an ohm meter?

I prefer to run them up to operating voltage on a very well regulated lab grade power supply and measure the leakage. But, you can check them with an ohmmeter. Your results can vary depending on the sensitivity of the ohmmeter. The one I use for checking caps and leakage between if and rf coil windings in the R390A's etc, can measure to 5000 megohms.

I always test all replacement caps for leakage at full operating voltage and for value before I install them. I'm never had a new orange drop or CDE cap fail. I have with others.

As much trouble as it is to recap something like the IF deck, there's not a shot in hell that I'd try to save a couple of dollars and use a lesser grade of capacitors. You only talking about 18 or 19 axial leaded "paper" caps. I think that the current average price on the 400 and 600V OD's from Mouser right now to totally recap the IF deck is under $20.00. I'd spend the $20.00 on the OD's even if the other caps were totally free.

Ditto for the three axial leaded paper caps under the RF deck... They're easy to change AFTER you remove the front panel and the RF deck. So, I'm going to attempt to save a dollar by replacing those three caps with something less than an OD? No way bubba. I look at using high quality parts as insurance.

Date: Thu, 6 Jul 2000 19:53:57 -0400
From: Bruce D MacLellan <brumac@juno.com>
Subject: [R-390] Paper caps vs OD's

Now that a lot has been said, remember one thing:

> Long after the sweetness of the low cost is gone,
> The bitterness of the poor quality remains!

I can't remember who the author is/was, but in my experience, it is sooo true

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Date: Thu, 6 Jul 2000 20:19:41 EDT
From: W2ZR@aol.com
Subject: [R-390] Re: [Hammarlund] Paper caps vs OD's

Sir Henry Royce, partner of Charles Rolls, said, "The quality remains long after the price is forgotten".

Date: Thu, 6 Jul 2000 22:59:32 -0400
From: "Barry Hauser" <barry@hausernet.com>
Subject: Re: [R-390] Paper Caps and Water Pumps...

Yeah, Dan, on that order, pleeze make sure the modules match up. And you_are_ gonna ship it on over to Nolan so he can tweak up the gear train to .00001 tolerance, right? <coff coff> Don't forget the Rippel rebuilt plug in caps. Shipping is included, right? ;-)

Not sure what set it off the caps issue as I pretty much assumed OD's were universally preferred for the R-390A's with a very few exceptions (people and caps)

But, sometimes I get the sense that those who prefer the yellow axial polyesters and polyethylene jobbies do so for their "axialness", not cheapness. Also, they fit better in some tight places, although are prone to soldering iron damage. Someone strongly recommended the yellow poly's for recapping a Hallicrafters SX-42 which originally comes with waxworks caps. This guy has restored a number of those with success and the radios have been in operation for a while. Are they not to be trusted?.

Now, I'm not naming names, but there is a guy on this list whose first name begins with a "C" who will roil and boil at the notion of using OD's on a military rx, saying that they're not authentic anyway. He favors disc ceramics. (Chime in if you wanna). I do have some mil rx's with OD's -- like the R-1051x's. However, he reports replacing many gazillions of tubulars with discs and with glee -- not all in R-390'a though.

Then there was the guy on the Halli list who felt that wholesale recapping is an invasive abomination that ruins the value of the specimen. He also felt that gutting big old wax capacitors and putting new ones inside was also a bad thing and deceptive. There is an outfit that makes replicas of the old wax caps at a steep price. But he would only replace caps as needed (not all the leaky ones, etc.) with an NOS unit. If not possible, he would keep the rig authentic as a non-working shelf piece. (Of course, I tried to explain that many of us like the idea of actually running the gear or might otherwise go into beanie babies or something.)

I don't think price is really much of an issue on the caps, though. Just looking at the AES catalog for .01 mfd/600v units, the 50+ price for yellow polyester vs. OD polypropylene film is 30 vs. 45 cents. Go up a notch on both -- metalized polypropylene yellows at 36 cents vs polyester film OD's at 49 cents. Difference is only 15 or 13 cents, or cheaper yellow to better OD is 19 cents. Mouser's prices might be better. So, what are we talking about?

BTW - is there a quality or characteristic difference between the polypropylene and polyester OD's?

Now, when it comes to SP-600's, it seems they went from BBOD's and GLOD's to disk ceramics back at the factory and followed through with that choice on later Hammarlunds. But that's a 'nother religion.

Well, I've started to save some candy and gum wrappers. with the thin paper backed aluminum foil so I can roll my own. How tight should I make 'em? Will liquid solder work on the leads? Should I dip 'em in wax or epoxy? Does epoxy come in orange? For the bathtub caps, can I use Mobil One? Gotta save up to buy an $85 carrier meter. ;-)

Date: Fri, 07 Jul 2000 20:43:10 -0500
From: Nolan Lee <nlee@gs.verio.net>
Subject: Re: [R-390] Paper Caps and Water Pumps...

I've been out of the loop with some computer hardware failures of the old system. I put together a new system and the new MB experienced crib death after a couple of days. It then took 8 days to receive the

replacement. ;-(It seems stable now.

>.....those who prefer the yellow axial polyesters and polyethylene jobbies do so for their "axialness", not cheapness.....

I bought a mess of the yellow caps from AES back in the early or mid 1990's. I use them in some stuff. Namely things that are easy to work on and easy to troubleshoot somewhere done the line if the cap pukes.

>Also, they fit better in some tight places, although are prone to soldering iron damage.

They ARE much easier to fit into a tight spot and using soldering shields can prevent damaging them. It is very tedious to shape the leads on the OD's properly for an IF deck OH.

>Someone strongly recommended the yellow poly's.....

I can't remember any specific failures of them, but my goal was reliability, not cost savings.

>.....begins with a "C" who will roil and boil at the notion of using OD's on a military rx...,

Neither is the black discoloration on the underside of the chassis and the surrounding wiring when one of those "authentic" caps cut loose. Not to mention the destruction of the surrounding "authentic" parts in that particular circuit.

>He favors disc ceramics. (Chime in if you wanna).

I only use ceramic disc capacitors to replace existing ceramic disc capacitors.

>I do have some mil rx's with OD's -- like the R-1051x's.

Yes, I have seen a couple of OD's in depot overhauled R-1051B's and depot overhauled modules.

>... replacing many gazillions of tubulars with discs.....

Doesn't sound very "authentic" to me...

>Then there was the guy on the Halli list who felt that wholesale recapping
>is an invasive abomination that ruins the value of the specimen.

So is a prostate exam. But preventive maintenance beats the hell out of the alternative. When I went thru the 67 EAC, my goal was an end product, to USE, that was as reliable and maintenance free as I could make it. The consensus among the highbrows that I queried was to use OD's. I did. Let's see, that was 15,100+ hours of "power on" ago. As to the "value of the specimen" I could care less. I plan to have that receiver for the duration. Maybe even longer if my Viking Funeral plans work out...

>He also felt that gutting big old wax capacitors and putting new ones inside was also a bad >thing and deceptive.

<yawn>

>There is an outfit that makes replicas of the old wax caps at a steep price. But he would only >replace caps as needed (not all the leaky ones, etc.) with an NOS unit. If not possible, he >would keep the rig authentic as a non-working shelf piece.

Now that's an idea. Damn, I guess that I was eat up with the dumb ass to have not though of that before. I wasted hundreds of hours on the EAC when I could have simply slipped it in the rack and never plugged it in!

>(Of course, I tried to explain that many of us like the idea of actually running the gear or >might otherwise go into beanie babies or something.)

Now THAT's an idea..... ;-(

>I don't think price is really much of an issue on the caps, though. Just looking at the AES >catalog for .01 mfd/600v units, the 50+ price for yellow polyester vs. OD polypropylene film >is 30 vs. 45 cents. Go up a notch on both -- metalized polypropylene yellows at 36 cents vs >polyester film OD's at 49 cents. Difference is only 15 or 13 cents, or cheaper yellow to better
>OD is 19 cents. Mouser's prices might be better. So, what are we talking about?

Less money than I spend on kitty treats.

Date: Mon, 10 Jul 2000 22:45:23 -0400
From: Al Solway <beral@videotron.ca>
Subject: [R-390] Orange Dropsand Gear Train

Thanks for the advise from all who responded to the revisited capacitor debate. I just hope that I have not taken up to much of all your valuable

time. Here is what I decided to do. I will use the O.D.s for all positions except for the Audio Chassis where I will use a smaller .01 and .033 on the terminal board.

Now for another question. This time a mechanical one. After doing a complete cleaning and lubrication of the gear train I noticed that there was a rough rasping sound when rotating the megacycle knob. I found that when the indent spring was loosened the rough sound stopped. Further investigation showed that the indent ring indents were pitted. The pitting was remove with a burnishing compound. The indent spring was removed.

Close inspection showed wear down to base metal at the point of contact with the indent ring. The base metal is most likely barium copper plated with harder a material. (Nickel???) I tried moving the indent spring away from the mounting wall which gave a new contact point to the indent ring. This seemed to work after a fashion. The operation was marginally smooth. To get a good positive indent response quite a bit of pressure was required on the indent spring. I suspect the geometry of the indent spring interface with the indent ring is no longer satisfactory. Any ideas. Hope that my description makes sense. By the way with the indent spring removed operation is very smooth and light as is the the kilocycles gear train.

Date: Sat, 08 Jul 2000 22:58:30 -0500
From: "Dr. Gerald N. Johnson" <geraldj@ames.net>
Subject: Re: Fw: Re: [R-390] Paper Caps and Water Pumps...

I have longer experience with OD than any other plastic film capacitor and have abused them more and found them surviving the test, such as going through the manual washing machine including the wringer and then the high speed electric clothes dryer with no detectable increase in leakage. I've not tested all the others that way. So I prefer Orange Drops...

At IF and RF frequencies the .05μF disk gave a lower reactance than the 0.1μF paper because of the inductance of the paper capacitor of that era (include Orange Drops of that era). Now the available Orange Drops are extended foil so the wrapping of the assembly doesn't add inductance.

Date: Tue, 12 Sep 2000 10:54:39 -0500
From: "Dr. Gerald N. Johnson, electrical engineer" <geraldj@ames.net>
Subject: Re: [R-390] V201 Bypass Cap Revisited

Yah, I left out a NOT. Should say there's NOT a 5000 pf capacitor on pin 5. Should be on pin 4. Could be some production line type messed up but that should make a dead as burnt toast rf stage. Has this RF section ever

worked?

The plate feed bypass shorted would fry the plate resistor. Not a common failure, but not out of the question. Definitely not common enough to require shot gunning with new disk ceramics. Besides who knows the new ones are good at voltage.

Many parts are sample tested these days, not 100% tested by the vendors. It doesn't hurt to check them again before installation. It costs more on the production line to install most small parts (resistors, capacitors, transistors) than to buy them and several times as much to find and replace the bad ones so 100% incoming inspection can pay off. It costs considerably more to find the bad parts in the field and fix them.

Date: Thu, 21 Sep 2000 19:16:35 -0400
From: "JM/CO" <jmerritt2@capecod.net>
Subject: Re: [R-390] Tantalum vs. Aluminum electrolytic

The big advantage of tantalums is their much smaller size as compared to the same value aluminum. For this, the price is, literally, higher cost. As far as leakage etc, I don't think that there is any difference, but there IS one characteristic of tantalums that bears noting, as this has caused me some problems until I came to an understanding. This is referred to as " memory
effect", and works this way: Suppose you have a tantalum rated @ 25 working volts, and the normal voltage in the circuit is , say, 18 volts. After a period of time operating at this voltage, the Cap " remembers" that it is an 18 volt cap, rather than a 25 volt one. Trouble starts when some other component in the ckt. (typically a transistor) malfunctions, and the voltage across the tantalum RISES. Even if this higher voltage is within the rated 25 volts of the capacitor, it will short out. Now after you locate and replace that faulty transistor, you will apply power to the circuit, thinking that all is well, and now you have a short instead of a capacitor, and more damage occurs. I went round and round inside of a Kustom 100 watt solid state guitar amp a while ago, and kept coming up with shorted tantalum caps. Finally, in the interest of time (and an affordable repair bill) I changed ALL of the tantalums for aluminums, and the problem was solved.

Date: Thu, 21 Sep 2000 21:11:36 -0400
From: "Walter Wilson" <wewilson@knology.net>
Subject: Re: [R-390] Tantalum vs. Aluminum electrolytic

Hollow State News, Issue 49, has this to say about tantalum caps:
"Tantalum capacitors are physically smaller than electrolytics for a given electrical size (but likewise polarized) and will therefore be less inductive,

have lower leakage, etc. Not bad for audio. Early tantalums were failure-prone; when you stuff lots of C into a small space you pay a price, in cash and in figuring out the how of it. Modern ones are pretty good; for audio applications needing high capacity and in which there'll be some DC to keep the electrochemical activity happy, they are a good choice."

Regarding electrolytics: ..." can exhibit significant inducance... will always show some parallel or leakage resistance... poor performance at the higher frequencies...excellent in power supplies, a bit iffy with audio..."

Date: Thu, 21 Sep 2000 21:11:27 -0500
From: "Dr. Gerald N. Johnson, electrical engineer" <geraldj@ames.net>
Subject: Re: [R-390] Capacitors SM vs Dura?

The only place on the internet that admitted to DuraMica had only a line list (in Italian) listing DuraMica condensatores. The ratio of the two capacitors in the oscillator sets the feedback and hence the oscillation level. The series equivalent of the capacitors sets much of the shunt capacitance on the crystals and so helps set the oscillation frequency. I don't know that 2% mica capacitors will be more stable than 5%, I suspect they are made of the same materials (not like ceramics with different dielectrics), just more precisely adjusted to value. 100 volt micas would survive in that circuit which will have only 10 volts RMS or so applied. The selections of mica capacitors seem limited these days. May well be only available on a factory production order or from NOS until the NOS is depleted. 73, Jerry, KOCQ

Date: Thu, 21 Sep 2000 21:11:21 -0500
From: "Dr. Gerald N. Johnson, electrical engineer" <geraldj@ames.net>
Subject: Re: [R-390] Tantalum vs. Aluminum electrolytic

In my experience, tantalum capacitors have less leakage and far less inductance than aluminum electrolytics. Most modern tantalums are solid, actually the metal surface is a sponge of metal which gives a large area and almost no inductance. Wet tantalums could be made of rolled foil, much the same as aluminum capacitors to contribute considerable inductance.

Tantalums can ignite if the voltage applied exceeds their capabilities. I've done that a few times with a switching supply dumping energy from an inductor that was way too large when the load was removed rapidly. I protected the tantalums with a 25,000 uf or so aluminum electrolytic to absorb the energy dump and that computer switching supply ran from 1978
to 1997 24/7, missing only 40 hours, mostly due to a pinched line wire in the cabinet. I applied tantalum capacitors to the cathode bypass and to a

low pass filter in the grid circuit of the audio output tube in my SB-110A several years ago. I found their high quality induced the tube to oscillate at something like 50 or 100 KHz. Well out of my hearing, but not good for the audio tube which wasn't loaded. I had to insert series resistors on some of the capacitors to damp that high frequency oscillation. In this case aluminum would have been too lossy at the ultrasonic frequency to allow oscillation.

I'd rather put up with solving capacitors too good than having the capacitors go bad repeatedly, as electrolytics WILL do. The miniature electrolytics of today's Pacific rim commerce are often bad when I receive them unless I pay premium for the highest temperature, lowest ESR (Equivalent Series Resistance) versions. I have found the miniature aluminum electrolytics to be more predictably bad than black beauties and in maybe 1/2 or 1/3 the elapsed time. Not so often leaky, more often nearly open which cuts gain. In 25 years when we start restoring sand state equipment it will prove to be SOP to shotgun all the aluminum electrolytics. That will save a lot of trouble shooting today already.

Date: Fri, 22 Sep 2000 04:22:57 -0400
From: twleiper@juno.com
Subject: Re: [R-390] Tantalum vs. Aluminum electrolytic

Another is that they blow / burn up when they fail. That "memory effect" seems to apply to "no voltage" as well, meaning that if they sit on the shelf for a couple years after having been used, they "remember" that they are now a ZERO voltage cap, and blow up when you power them up. This happens to us when we use repaired boards that have been sitting on the shelf for a year or two...

Date: Fri, 29 Sep 2000 21:49:50 -0400
From: "Walter Wilson" <wewilson@knology.net>
Subject: Re: [R-390] cap opinions?

- --- Capacitors --- My advice: Get 'em all out o' there. Why stop at just a few Orange Drops? Add some real color to your IF deck. I always replace every brown beauty, Aerovox film, and hermetically sealed can capacitor. ALL paper caps. I also replace the tantalum and C327 (100 pF mica with a NPO ceramic). C327 is so often bad, causing bands below 8MC to be weak or dead. While you're in there, check the resistors, and especially the larger wattage one. But some of the 1/2 watt ones drift up, too. Replace any that have drifted more than 10%. And don't forget the filter caps, C603 and C606 on the AF deck (in the tall silver cans).

- --- 455 KC oscillation --- Is this a squeal on AM? Is it the same with all the filters? Lots of possibilities.

- --- Static crashes ---

Replace all those paper capacitors, and see if it's still there. Tracing with an oscilloscope can help if you have one. If you don't, remove the coax connectors coming from the RF deck. If it's coming from the RF deck, they will go away. On whichever deck (IF or RF) the problem lies, pull the tubes starting with the first stage, and progressively remove tubes (disabling that stage) until you isolate it to a stage. Once you isolate the problem, substitute the tube in that stage first. If no better, get a can of freeze spray and cool down the capacitors in that stage with the radio on (careful, lethal voltages). That can sometimes pinpoint the problem. I've also had some bad static that was drastically reduced by finding and repairing some bad solder joints. The one that got me was under the hooded connector going to the IF deck, so was a little more trouble to discover. Chassis wiring can certainly be where the problem is sometimes.

DeOxit spray on switches and connectors and tube pins should also be done.

I know, it sounds like I'm suggesting you rebuild the radio. Yeah, do that too. I'm working on two of them right now (and still listening on the third one in the shack), and it's a blast. R-390A receivers are like a Lay's potato chip: Nobody can have just one.

Date: Fri, 29 Sep 2000 20:17:15 -0500
From: "Dr. Gerald N. Johnson, electrical engineer" <geraldj@ames.net>
Subject: Re: [R-390] cap opinions?

You can shotgun them while the module is easy to access or you can trouble shoot it capacitor by capacitor. Check the resistors also. Oscillation is a sign of open capacitors, mostly screen, AGC, and plate supply bypasses, popping and static crashes are often signs of bad solder connections and capacitors failing in the leaky mode. New films are better than old films.

To be really sure of a capacitor's quality you need to extract it from the circuit and check it for leakage with my power supply and VTVM check, then check it for value with a good bridge, then if its good find enough leads to put it back. Its more effective use of time to scrap it, forget the testing and install new capacitors.

Date: Fri, 20 Oct 2000 06:51:37 -0400
From: "Walter Wilson" <wewilson@knology.net>
Subject: [R-390] Capacitor value discrepancies - schematic vs. parts list

I'm working on an EAC now, and I noticed last night that the original C517 is a 0.1 uF capacitor. This value agrees with the parts list value, but the schematic shows 0.01 uF. These errors persist in both TM 11-856A and the Y2K manual. Has anyone tried to resolve the values between the schematics and parts list, especially on the paper capacitors? I've always replaced with the same value as I removed, but this got me in trouble with C327. I'm going to start recording all these and I'll post it on my website when finished, but if anyone has this list already started it would be a big help.

Date: Fri, 20 Oct 2000 10:18:53 -0400 (EDT)
From: Norman Ryan <nryan@duke.edu>
Subject: Re: [R-390] Capacitor value discrepancies - schematic vs. parts list

The schematic with the 8 Dec 1961 edition of TM 11-5820-358-35 shows the correct value for C517-- 0.1uF.

Above cited schematic shows C275 to be 5,000 pF. Correct value is .033 uF. (Already discussed recently.)

C227 gets an additional silver mica wired in parallel-- 68 pF.

R601 gets a 68 pF silver mica wired in parallel also.

R504 is changed from 1000 Ohm to 560 Ohm.

Navy Field Change #7 changes R210 from 56K to 220K. Same thing with R702.

Not sure if this is complete, but as Les says, "that's my story and I'm sticking to it." :-)

Nolan has a pretty fine capacitor list that he posted to the reflector. I bet he'll e-mail it to you on request.

Date: Fri, 20 Oct 2000 10:58:02 -0400
From: "Walter Wilson" <wewilson@knology.net>
Subject: Re: [R-390] Capacitor value discrepancies - schematic vs. parts list

> Above cited schematic shows C275 to be 5,000 pF. Correct value is
> .033 uF. (Already discussed recently.)

I thought the recent discussion seemed to confirm that C275 is supposed to be 3300 pF or 0.0033 uF, based on the schematic and the production

mod info and NOT based on the parts list which shows 0.033 uF. Jordan said that 3300pF improves sensitivity on the lower bands significantly versus 0.033 uF. The original value was indeed 5000 pF, but was changed during a production mod. I plan on trying to confirm Jordan's findings in the near future. Thanks for all the information. That's a good start.

Date: Wed, 25 Oct 2000 19:23:29 -0500
From: "Dr. Gerald N. Johnson, electrical engineer" <geraldj@ames.net>
Subject: Re: [R-390] tube/receiver life (17.6K hours)

NO NO NO! I came to the conclusion that replacing all paper capacitors was the right thing to do independently, at least 15 or 20 years ago. After reworking an NC-300 that had been my high school buddy's and had been sitting in a Florida closet for at least that long... I pulled and checked each capacitor with my tough test (vtvm and power supply) rejecting all capacitors with more than 0.1 microamp of leakage and passed none. Made me conclude that those high quality looking molded capacitors (none were cracked open unlike black beauties who like to split lengthwise) did not age well and that Orange Drops would save a lot of trouble shooting. Nothing in my subsequent experiences has changed that opinion except to learn that the miniature electrolytics of "modern" equipment have shorter lives than those oiled paper capacitors so that the "modern" equipment running on low voltage needs the same wholesale capacitor replacement, but this time with the best available (low ESR, high operating temperature) miniature electrolytics if not solid tantalums.

Realistically, probably anyone who did a thorough test of all the paper capacitors in a receiver or two would have concluded that life was simplified and productivity improved by simply replacing every paper capacitor because by the time one removed the old capacitor for testing and retained enough lead for reinstallation and did the testing, he could have replaced three or four capacitors with new capacitors. The difficulty of circuit tracing in the modular R390 style receiver makes shot gunning the capacitors far more practical.

And to the contrary, I never replaced all the capacitors in an AC/DC radio because there weren't very many to trouble shoot. Maybe two screen bypasses, one detector bypass, and one audio coupling capacitor. I doubt if any of those blobs of wax would have passed my tough test, but there wouldn't have been enough leads left to put them back anyway.

Date: Thu, 26 Oct 2000 18:32:20 -0500
From: Perge <perge@attglobal.net>
Subject: [R-390] yellow caps?

Are 0.1uf yellow caps at 630v worth using in a R-390a? I know the orange drops are popular but how about the yellow ones for the IF deck?

Thanks,Joe,WB8HWF

Date: Thu, 26 Oct 2000 19:47:00 EDT
From: Llgpt@aol.com
Subject: Re: [R-390] yellow caps?

I'll probably catch HELL from the professors and rocket scientists on the list, but i have used many of these from Antique Electronic Supply on R-390A's, SP-600's and SX-62A's with no ill effects. Are they better/comparable to Orange Drops ?? I haven't asked my laboratory assistant Joe (Igor) Foley yet. But, I suspect they will work just fine.

The Sprague Orange Drops are probably much better on audio circuits, and many will argue they are just better period. Well, I don't use 26Z5W rectifier tubes, and have forgone the 3TF7 for a (gasp !!!) solid state modification, so i am a heathen.

Date: Thu, 26 Oct 2000 20:17:51 -0400 (EDT)
From: Norman Ryan <nryan@duke.edu>
Subject: Re: [R-390] yellow caps?

These are new units, right? If so, they're probably poly-something or other and are OK. Down side to them is you have to be super careful not to touch the yellow with your soldering iron. The plastic melts readily. Whatever you do, don't use paper caps as they tend to be leaky from the start and worsen with age. Got room for the 630 V units? If not, 400 V will work. Original spec calls for 200 V., but the higher working voltage gives an extra margin of reliabilty. Hope this helps.

Date: Thu, 26 Oct 2000 20:29:12 -0400
From: "Phil (VA3UX)" <phil@vaxxine.com>
Subject: Re: [R-390] yellow caps?

Almost any modern capacitor is better than almost any 25 to 50 year old, paper & wax capacitor. Orange Drops are good but there are plenty of modern film/foil/polyester/ polystyrene/whatever capacitors that will do just as well. There's nothing magic about Orange Drops. Having some capacitor manufacturers catalogs around certainly helps in choosing capacitor types for critical applications.

Date: Thu, 26 Oct 2000 20:35:53 -0400

From: "Walter Wilson" <wewilson@knology.net>
Subject: Re: [R-390] yellow caps?

I'd use Orange Drops if I had both lying around or if I had to order some. But if someone dropped a bunch of yellow ones at my door, I'm sure they'd find their way into a radio. I don't snatch out any 26Z5W rectifier or 3TF7 ballast tubes, but if they fail, they don't get replaced. After failure, I solid state the power supply (standard military mod), and I already have the jumpers on all my IF decks so I can drop a 12BH7 in there when the 3TF7 fails. (I hope they don't throw any big rocks at us.... running and duckiing also)

Date: Thu, 26 Oct 2000 20:43:30 EDT
From: Llgpt@aol.com
Subject: Re: [R-390] yellow caps?

Now, that is the one thing I forgot to mention, they do sizzle and droop quickly when a soldering iron touches them. < grin > Les Locklear

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Date: Thu, 26 Oct 2000 20:03:18 -0500
From: Nolan Lee <nlee@gs.verio.net>
Subject: Re: [R-390] yellow caps?

>I'll probably catch HELL from the professors ..... And some rednecks too! :-)

>I have used many of these from Antique Electronic Supply on R-390A's, SP-600's and SX-62A's >with no ill effects.

I've used them in some stuff too but as much trouble as it is to recap an R-390A, I wanted to do it one time and used the best capacitors I could find. It's a pain in the ass to fit the OD's into the IF deck. The yellow caps would make the job a hell of a lot easier. Maybe by a factor of five.

>Are they better/comparable to Orange Drops ?? .

One of the things I don't like about them is their resistance to accidental contact with the soldering iron. soldering shields made from aluminium cola or beer cans are a must when using the yellow caps.

>Well, I don't use 26Z5W rectifier tubes, and have forgone the 3TF7 for a (gasp !!!) solid state modification, so i am a heathen.

He's a WITCH! BURN HIM! Oops, sorry. I'm caught up in this pagan holiday. <grin> nolan

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Date: Thu, 26 Oct 2000 21:02:43 EDT
From: Llgpt@aol.com
Subject: Re: [R-390] yellow caps?

>>>Same here Walter, I use what fits best usually <grin >.

I don't snatch out any 26Z5W rectifier or 3TF7 ballast tubes, but if they fail, they don't get replaced. After failure, I solid state the power supply (standard military mod), and I already have the jumpers on all my IF decks so I can drop a 12BH7 in there when the 3TF7 fails.

Date: Thu, 26 Oct 2000 22:06:13 -0400
From: "Barry Hauser" <barry@hausernet.com>
Subject: Re: [R-390] yellow caps?

Anybody ever consider fitting the yellow caps with teflon tubing to help protect them while soldering? Would it help?

Date: Thu, 26 Oct 2000 20:52:18 -0500
From: "Dr. Gerald N. Johnson, electrical engineer" <geraldj@ames.net>
Subject: Re: [R-390] yellow caps?

Not all poly capacitors are made equally. First there's that soft case of some, and the internal construction. Some have extended foil for extremely low inductance (Orange Drops), some don't. Some have different thickness of dielectric giving different reliability factors. The original capacitors were not extended foil and were not so effective as RF bypasses as IF bypasses. Besides` I've been using Orange Drops for at least 40 years and still find them reliable. I don't know about the others that haven't been made that long.

Date: Thu, 2 Nov 2000 12:58:09 -0600
From: "Scott, Barry (Clyde B)" <cbscott@ingr.com>
Subject: [R-390] C275

I'm still trying to determine if I need to change this cap or not. As we've discussed before, the original schematic called for 5,000pf with a mod that supposedly was meant to change it to 3,300pf but some of the schematics were somehow mislabeled to 33,000pf (0.033ufd instead of 0.0033ufd).

I have two Motorola decks, both of which had 33,000pf brown beauties for C275. I replaced C275 in the one I'm actually using in the radio with a 33,000pf. Now the word is that should really have been 3,300pf.

What is the significance of changing this cap to 3,300pf? Dr. Jerry

mentioned possible problems with oscillation of the VR tube if the C gets too high here. Are there other symptoms I should look for? The radio seems to play fine but if this would improve it I wouldn't hesitate to change this cap. It's pretty easy to get to and replace.

Date: Thu, 2 Nov 2000 17:26:23 -0500 (EST)
From: Norman Ryan <nryan@duke.edu>
Subject: Re: [R-390] C275

It's .033 uF. It's also 33,000 uuF or 33,000 pF.
Use an Orange Drop cap or equivalent and C275 will be right as rain.

Date: Thu, 02 Nov 2000 17:31:56 -0600
From: "Dr. Gerald N. Johnson, electrical engineer" <geraldj@ames.net>
Subject: Re: [R-390] C275

Depends on where you look. The TM-856A (Jan 1956) schematic calls for .005, the Y2K schematic calls for .0033, the MWO call for .0033, the parts list calls for .033, and refers all the disk ceramic .005 to be the same as C275. There's confusion in the documentation and the Y2K manual. And Jordan Arndt detects that the receiver gain 0-8 MHz is lower when C275 is .033 than when its .0033... The CD-ROM is just as confusing.

Date: Thu, 02 Nov 2000 23:56:57 -0700
From: Robert Tetrault <tetrault@teleport.com>
Subject: Re: [R-390] C275

My two cents: I just re-capped, re-resistored everything, did the end point adjustment, then a careful alignment, with HP606B and Weinschel attenuator. Sensitivity is flat across all bands with C275 a nice 3300pF Silver Mica that I just installed per Y2K.

Date: Fri, 3 Nov 2000 09:40:46 -0600
From: "Scott, Barry (Clyde B)" <cbscott@ingr.com>
Subject: RE: [R-390] C275

It seems we have two cases here, both of which seem to work. Has anyone done a comparison using a 0.033uf and a 0.0033uf and been able to see any differences? Thanks, Barry - N4BUQ

Date: Fri, 3 Nov 2000 10:35:20 -0500
From: "AI2Q Alex" <ai2q@ispchannel.com>
Subject: [R-390] RE: C275

Barry, what's all this angst about C275 anyway? Not to worry OB. It's simply a bypass capacitor on the regulated 150 V line. It's purpose is to

ensure a low-impedance path to ground for any signals that may inadvertently appear on the screen of the 1st XTAL oscillator tube. At 17 MHz, the reactance of a 5000 pF cap is less than 2 ohms. Using a 0.033 uF cap lowers the reactance at 17 MHz to 0.28 ohms. Do you really think that's going to make any difference? The proof of the pudding supplies the answer: Your change made no perceptible difference. If the VR tube is stable, why fiddle with the cap?

Date: Thu, 09 Nov 2000 19:50:45 -0800
From: Robert Tetrault <tetrault@teleport.com>
Subject: [R-390] C275

Reviewing TM5320-358-35, I find several explicit references to changing C275 from 5000pF to 3300pF. These references are found on:

p 17 of 190 pdf, TM page 3 p 25 of 190 pdf, TM page 11 p 26 of 190 pdf, TM page 12

Is this settled, or has some sinister force made changes to government property? <G>

Date: Fri, 10 Nov 2000 06:09:24 -0500
From: "Walter Wilson" <wewilson@knology.net>
Subject: Re: [R-390] C275

It's settled in my opinion. Just would be nice if the parts list agreed. And also the fact that I have found several "original-looking" brown tubular 0.033 uF caps in several rigs. But other than that, it's settled. 3300 pF. I even tried both in an EAC rig I'm rebuilding. No discernable difference in sensitivity.

Date: Fri, 10 Nov 2000 10:21:48 -0500
From: "AI2Q Alex" <ai2q@ispchannel.com>
Subject: RE: [R-390] C275

Walter, as I mentioned in a previous note (which you may not have noticed), cap C275 is a bypass capacitor on the regulated 150 V line that feeds the oscillator and the first mixer tubes. It's purpose is to ensure a low-impedance path to ground for any signals that may inadvertently appear on the screen of the 1st XTAL oscillator tube. If you study the schematic, you'll see that it bypasses 150 V regulated coming in at J208 when the Megacycle Change knob switches on the 1st XTAL oscillator. C275 is part of a pi-type filter additionally comprised of R210 and C326.

The capacitive reactance of this cap (Xc) = 1/ 2(pi)Xc(f), so at 17 MHz, the reactance of a 5000 pF cap is less than 2 ohms. Using a 0.033 uF cap

lowers the reactance at 17 MHz to 0.28 ohms, which is even better. That's NOT going to make any difference to the set's sensitivity. The points it bypasses protects are all DC. The cap has nothing to do with setting any signal levels or sensitivity. You want a nice low-impedance to ground for any stray RF on this DC line, and that's the purpose of the cap. To me, it doesn't seem too critical. The 0.033 uF value is best however.By the way, the NAVSHIPS 0967-063-2010 manual (a diagram circulated widely in this group) has a serious error. It shows TWO placements of bypass cap C280 at the 1st mixer. If that were true (which it isn't), there would be no route for B+ to the plate of V202! This cap is at section E-3 of the Navy diagram. The schematic is correct in the "21st Century R-390A/URR Reference" in Figure 5-19 on page 5-45 as supplied by KH6GRT, Pete Wokoun.

Date: Fri, 10 Nov 2000 10:15:06 -0600
From: "Scott, Barry (Clyde B)" <cbscott@ingr.com>
Subject: RE: [R-390] C275

A 3300pF has about 2.8 ohms reactance at 17mgc making the choice of 0.033uF seem a better choice in the first place. It would appear it's nitpicking at best, but it sure seems the 0.033uF is a better choice. Also, I think there's a typo in your formula. (Xc)=1/2(Pi)FC.

Date: Fri, 10 Nov 2000 11:33:06 -0600
From: "Dr. Gerald N. Johnson, electrical engineer" <geraldj@ames.net>
Subject: Re: [R-390] C275

A modern orange drop will give better results at C-275 than a vintage paper because the modern orange drop is extended foil which means very low inductance and the vintage paper was inductive and self resonant more like a couple MHz and so less effective at the 18 to 30 MHz range present at that point in the radio. Everything but the parts list says .0033 or .005 in the older schematics. The parts list is probably wrong, but how to prove it? The picture in the Y2K manual clearly shows a .033 brown tubular.

The fact that the inductance of the old paper capacitor would make it far less effective is one reason for the smaller capacitor. Some time ago, there was a post on some list about the low sensitivity of some WW2 vintage radio above 15 MHz where paper capacitors were used as cathode and screen bypasses. I suggested paralleling them with .001 or .005 disk ceramics to have better bypassing and the report was that addition definitely improved the radio significantly.

There is a possibility that the .033 plus the other bypasses in the circuit could reach a total value (the 0A2 data sheet says 0.1 is the maximum

shunt C) across an aging 0A2 and cause it to oscillate and inject noise into the receiver. The .0033 makes that very remote.

Date: Fri, 10 Nov 2000 13:04:24 -0500
From: "AI2Q Alex" <ai2q@ispchannel.com>
Subject: RE: [R-390] C275

Yes, indeed I wrote (Xc) = 1/ 2(pi)Xc(f) when it should be (Xc) = 1/2(pi)f(C) as you show it Barry. Thanks for the catch.

Date: Fri, 10 Nov 2000 17:28:24 -0500
From: "Phil (VA3UX)" <phil@vaxxine.com>
Subject: RE: [R-390] C275

The correct placement of the brackets would be : Xc = 1/(2*Pi*F*C)

Date: Fri, 10 Nov 2000 17:29:18 -0800
From: "Rob Dunn" <dunnr@ix.netcom.com>
Subject: Re: [R-390] C275

I have read this thread while waiting for my son to get his hair cut at the barber shop and I can't help but reply. There is an error being tossed around that leaves the question of capacitance values still unresolved. Walter Wilson wrote below:

> > It's settled in my opinion. Just would be nice if the parts list agreed. And also the fact that I >>have found several "original-looking" brown tubular 0.033 uF caps in several rigs. But other >>than that, it's settled 3300pF.

The error is in considering a 0.033uf capacacitor equivalant to 3300pf, it is not. 3300pf is equal to 0.0033uf NOT 0.033uf. Conversely 0.033uf is equal to 33,000 pf. The error is a factor of 10 and thus the reactance calculations shown below are different by a factor of 10. From the discussion I assume the value that is being discover in apparently original equipment is 0.033uf or 33,000pf. Is this correct?

Date: Fri, 10 Nov 2000 21:31:38 -0600
From: "Dr. Gerald N. Johnson, electrical engineer" <geraldj@ames.net>
Subject: Re: [R-390] C275

Robb you missed the point. The WMO say .0033 mf or 3300 pf. The parts list says .033 and many radios do have .033 paper. The original schematics say 5000 pf or .005 mf. It isn't us, it's the documentation that is confused.

Date: Fri, 10 Nov 2000 23:35:40 -0500 (EST)
From: Norman Ryan <nryan@duke.edu>
Subject: Re: [R-390] C275

The four R-390A's I've opened had the paper cap also: .033 mF (or 33,000 pF if you like).

Date: Sat, 11 Nov 2000 02:38:50 -0800
From: "GLEN GALATI" <ELDIM@worldnet.att.net>
Subject: [R-390] JUST A NOTE ON CAPACITORS

Just my 2-cents worth for the younger generation. With the advent of computers and those larger value capacitors, with particular reference to Electrolytics and their abbreviations. We of the "OLD SCHOOL" saw mf, mfd, MFD, ufd, as microfarads (10 to the negative 6th). A lot of the newer capacitor checkers show MFD as "MILLIFARADS" (10 to the negative 3rd). B&K had this confusing in their manual on the 878 Checker. The new WAVETEK LCR55 has corrected this identifying p=pico (-12), n=nano(-9), and u = micro(-6). When I went through BED (Basic Electronic Doctrine) at Keesler AFB, Mississippi in 1961 the instructor claimed that a 1 farad capacitor would occupy a full city block. Of course being a newby and green behind the ears I never questioned the matter. I just wonder what the breadown voltage was?

Date: Sat, 11 Nov 2000 05:29:04 -0600
From: Nolan Lee <nlee@gs.verio.net>
Subject: Re: [R-390] JUST A NOTE ON CAPACITORS

Now you can buy one the size of an olive for less than ten bucks from any number of parts suppliers. Amazing huh? Fifteen years from now, a farad will probably be the size of a grain of rice. Another fifteen years after than and we'll have the kilofarad or maybe even the "virtual farad"... <grin> Come to think of it, I need to place a parts order pretty soon to grab a few parts for the CV-591A overhaul project. I may just order one of the farad caps just for the hell of it.

Date: Sun, 12 Nov 2000 13:27:45 -0500 (EST)
From: Norman Ryan <nryan@duke.edu>
Subject: RE: [R-390] C275

Nice work! Have corrected my NAVSHIPS schematic (sheet 1) to eliminate the spurious C280.

Navy Field Change #7 calls for changing R210 from 56K to 220K. Dunno if this affects C275 (.033 uF) or not. I have a hunch changes made to C275 and R210 were prompted by the extraordinary conditions

encountered on Navy ships what with all their transmitter gear including radar. Lots of strong RF about. That or it was merely a way to get more use out of the occasionally iffy 0A2 VR tube.

It's a good bet most of us don't encounter the conditions that may have necessitated these modifications. But the debate has been fun.

Date: Mon, 13 Nov 2000 21:21:06 EST
From: DCrespy@aol.com
Subject: [R-390] C275

This is getting crazy over what I think is just a misprint.. Has ANYONE ever actually pulled a 3300 pf cap from an RF deck? All 4 of mine are .033uF.

Date: Tue, 14 Nov 2000 10:25:52 -0500 (EST)
From: Norman Ryan <nryan@duke.edu>
Subject: Re: [R-390] R-390A, C103

That's C103, not C102, right?

C103 is one of those "bathtub" oil capacitors which are generally reliable. I'd leave it in the radio and see if it performs OK when the time to power it up arrives. Good luck with your restoration.

Date: Tue, 14 Nov 2000 21:22:50 -0600
From: Nolan Lee <nlee@gs.verio.net>
Subject: Re: [R-390] R-390A, C103

> C103 is one of those "bathtub" oil capacitors which are generally reliable.

C103 is the bathtub style electrolytic on the rear panel. :-) It's something like 50 mfd at 50 volts. Probably the most reliable cap to re-stuff the can/bathtub would be a metal cased tantalum. That should last and would only cost a few bucks.

Date: Mon, 27 Nov 2000 14:40:36 -0500
From: rbussier@lexmark.com
Subject: [R-390] Capacitor experiences, one more time

I hope everyone had a happy and wonderful Thanksgiving. We all have much to be thankful for, I know I sure do! I would like to relay recent experiences I have had with capacitors in some old equipment. Those who chose not to read this rather long post, please 'delete' now. I've been a ham for 40+ years and have a shack full of the sand state stuff, but a year or so,

I got interested in boatanchors. I guess this was all triggered by the purchase of some Drake gear. Now I have a nice 75A-4, and a very nice 390A radio. Recently, I purchased several HP-608/C, D, and E, signal generators. I love these things! Not only excellent workmanship, a piece of cake to work on. A nice touch is that no 2 (that I have) are the same. HP must have made constant changes to these during production. Several of these did not function 100%. I also have an AN/URM-25 that was malfunctioning, until I replaced the "black beauty" caps. I have been reading everything I can on the old style caps in this old stuff. Interestingly enough, sages far wiser than me are polarized (sorry about the pun) into 2 camps on capacitor replacement. Some say replace them all, some say leave them alone. The following has been my recent experience, on the holiday break..... But first a word on the equipment used to check the caps..... I have several Heathkit cap checkers, a Sencore TO-6, and a Leader LCR meter (high end). However, after some private conversations with Dr. Jerry (THANKS, Jerry!!), I knew there had to be a better way. Dr. Jerry suggested using a variable HVDC power supply and a VTVM to check the leakage. Very simple, tie the P/S and VTVM grounds together and use the VTVM input for one lead and the HVPS B+, for the other. The little Heathkits output from 5 to 600 VDC. The Sencore is excellent, but kinda hard to find a decent one.

The first HP was a 608C. After replacing one bad tube, it had problems with the modulation (same problem the URM-25 had). so since pulling the 'black beauties' out of the SG had fixed that, I started there. The caps are easy to get to on the HP and this example had the black caps with the color code stripes. There are nine 0.01 UF and one 0.22 UF cap in there. Results:

Type	cracked?	value	test voltage	leakage VDC
Orange drop (control)	no	0.1	400	0
bk w/stripe	yes	0.1	400	155
" "				225
" "				149
" "				75
" "				151
" "				109
" "				188
" n				28
" n		.22µF	400	120

I had to keep going back to my OD to believe what I was seeing.

Next generator:

blk w/stripe	no	.1	400		280
"	"			266	
"	"			240	
"	"			310	
"	"			290	
"	"			260	
"	"			294	
"	"			303	
"	"			297	
"	"	.22µF	400	250	

Next generator (these had Sprague black caps in it with the value written on it
and one red stripe, same size as above)

Sprague blk	no	.1	400	.6	(that's POINT 6)!
"	"			.8	
"	"			.5	
"	"			.5	
"	"			.5	
"	"			.5	
"	"			.1	
"	"			.5	
"	"			.5	
"	"	.22µF	400v	1.2	

Since the 'postage spamp micas' are easy to disconnect, I pulled one end and checked them all.

MicaMold	no	2000pf	400		293
"	"	"	"	292	
"	"	"	"	298	

the rest passed with no leakage

I went back to my supply of caps. In there, were some of the red stripe Sprague (NOS), all were good. I found two blue, Aerovox 0.1 UF, NOS, as well. One leaked 79V, the other 10V. Trash time. Dr. Jerry's criteria is < 1.5 VDC leakage at rated voltage. Having piqued my curiosity, I checked some old sweep/signal generators I am restoring. These are full of the old, brown waxy caps. All NG. How does this relate to an R390a? I have spare modules for my EAC. I had previously done the recapping of the 'killer' caps as eloquently described by Chuck. The replacement IF module is a Stewart Warner. Just for fun(?) I cut one side of the brown tur* * and checked them. Every single one leaked like a sieve. Replacing these is an

order of magnitude more difficult than the caps in the HP generators. Looking at the IF schematic, most these caps are simply rf bypasses for the cathodes, but some are interstage coupling caps as well.

By the way, ALL CAPS (except one) listed above, CHECKED FOR PROPER VALUE IN THE LCR BRIDGE. The resistance could not be measured with a Fluke DVM, either. The 'eye' on the Heathkit checker indicated when the caps leaked, but the VTVM worked much better, being able to quantify, how bad the caps were. You can pick up an older VTVM and the Heathkit cap checkers for almost nothing on the dreaded "E-Pay".

Conclusions: Any black or brown tubular cap that has the colored stripes is
going to get pulled from all my equipment. I have only seen one of the Sprague caps with the red stripe fail, so when I encounter any, they will at least be checked.

It is interesting to note that one HP had most of it's caps cracked, age/heat failure, I presume Although the 'red stripe' jobs tested good, I replaced them all with Orange Drops, since it was so easy to do. Another 'test' mentioned by Dr. Jerry was to charge the cap up and just let it set. The leaky ones were deader than a hammer, after just a couple of seconds. The ODs seem to stay
charged forever. ESR, Equivalent Series Resistance

Although I haven't started on the SW IF module (or looked inside my 75A-4), if any caps with colored stripes show up, they are out of there. Any and all comments are welcome.

Date: Mon, 27 Nov 2000 15:03:36 -0600
From: "Scott, Barry (Clyde B)" <cbscott@ingr.com>
Subject: RE: [R-390] Capacitor experiences, one more time

Just curious: what VTVM were you using and do you know its resistance when measuring these?

Date: Mon, 27 Nov 2000 17:23:14 -0500 (EST)
From: Norman Ryan <nryan@duke.edu>
Subject: Re: [R-390] Capacitor experiences, one more time

If that isn't the definitive word on paper caps, I don't know what is. Nice work! From your experience with one or two micas, those don't look too good either.

Date: Mon, 27 Nov 2000 18:10:00 -0600
From: "Dr. Gerald N. Johnson, electrical engineer" <geraldj@ames.net>

Subject: Re: [R-390] Capacitor experiences, one more time

Micamold made a lot of molded paper capacitors that looked like mica but weren't.

Date: Tue, 28 Nov 2000 01:16:02 -0500
From: "Barry Hauser" <barry@hausernet.com>
Subject: Re: [R-390] Capacitor experiences, one more time

Great info! I'll have to archive your post in a special place -- where I can find it when I need it.

Don't you mean a Sprague TO-6? Or is there a Sencore with the same model number? Sprague made a TO-4, TO-5 and a TO-6 -- and it's hard to find one in top shape unless it was babied and recently recapped. I also picked up some HP generators -- 606A, 608C, 608E and 616x UHF jobbie. They seem to work mostly. I'll have to compare notes with you when I dig into 'em. Related question. One of my cap checkers is a Pyramid CRA something. This has a meter, no eye, but gives you readings on leakage. In checking one of the plugin caps -- the dual 45 Mfd/300V -- one section didn't test so well. It showed leakage of 6 ma at the rated voltage. (The Pyramid checker allows you to set the working voltage with a pot using its meter, then you switch to read leakage.) According to the chart and formula in the Pyramid checker, 6 ma. is within limits on a 45 Mfd 300v electrolytic, although on the high side. The other section and all three sections of the triple 30 Mfd plugin (always forget the "C" numbers, sorry) all showed leakage well below 1 ma. Isn't 6 ma. a tad high?

Ever notice that so many of the cap checkers were made by capacitor manufacturers? Pyramid, Sprague, Cornell Dublier, to name three. You'd think they'd set the redlines and manual data stringent as to sell more caps. But, I suppose there was always the risk that someone would test their new caps with one of these and raise Cain.

Date: Tue, 28 Nov 2000 09:58:36 -0500
From: rbussier@lexmark.com
Subject: [R-390] Re: Capacitor experiences, one more time

I'm glad everyone found my discussion on caps informative. I have had some feedback:

- - I mentioned I had a Sencore TO-6, That is incorrect, it is a Sprague TO-6.

- - Dr. Jerry said that "Micamold" made some caps that appeared to be mica, but were paper. I 'disassembled' one of the three bad caps today and

it is indeed mica. When I went through a pile of large micas I had, I found one of that batch (used) that leaked. It was also mica inside.

- - I used an old Knight VTVM. I won't swear to it's input impedance, but I believe it's 11 Meg. I didn't mention yesterday, that putting a Fluke DVM across the Knight VTVM, to verifiy the voltage, actually pulled down the reading, slightly. So, I would assume (oh oh, there's that word again), that the DVM has lower impedance than the VTVM. Fortunately, I collect VTVMs and have many. I'll try this with several brands/models,, to see if the results are consistent, but I'll bet an 807 that most of the VTVMs have 11 Meg input impedance.

- - One very important thing I forgot to mention, is that this test is more easily done on small value caps. By that I mean < .5 mfd. Above this, it takes a lot longer to charge the cap.

- - I left the cap checker/power supply set to 400 VDC for most of the testing. Start with the VTVM on the 500 VDC scale. As the cap charges, progressively lower the range. As seen by the results, some caps leaked so badly, the VTVM couldn't be lowered. Small value caps and ODs, cause the VTVM to go to 0 almost instantly.

- - One piece might have been confusing to most readers. The HPs have lots of mica caps in them. They simply are connected between two posts. It's easy to pull one end up for testing. Of all the 'mica' caps in the HPs, only 3 flunked and they came out of the same generator, and all looked the same and had the same value.

thanks for the input and if interested, I'll continue this when I get to the 75A-4, the 51J-3 and the 390A.

Date: Tue, 28 Nov 2000 13:22:35 -0500
From: "Phil (VA3UX)" <phil@vaxxine.com>
Subject: Re: [R-390] Re: Capacitor experiences, one more time

I still don't understand this business with the variable HVDC supply and a VTVM for checking leakage. If you have a Sprague TO-6, you already have all that built-in. The TO-6 has variable DC-out to around 500 volts and the meter on the front panel is in series with the supply for measuring the leakage current. Granted its aimed at typical electrolytic leakage values (6 ma or 60 ma full scale - selectable) but you can still measure down to 20 microamps. For smaller caps with really tiny expected leakage currents, you'd use the Insulation Resistance mode on the TO-6.

>lower impedance than the VTVM. Fortunately, I collect VTVMs and have many. I'll try this >with several brands/models,, to see if the results are

consistent, but I'll bet an 807 that most of >the VTVMs have 11 Meg input impedance.

Most modern DVMs have input impedance of 10 Meg or greater.

>- One very important thing I forgot to mention, is that this test is more easily done on small value caps. By that I mean < .5 mfd. Above this, it takes a lot longer to charge the cap.

> I left the cap checker/power supply set to 400 VDC for most of the testing.
>Start with the VTVM on the 500 VDC scale. As the cap charges, progressively
>lower the range. As seen by the results, some caps leaked so badly, the VTVM couldn't be >lowered. Small value caps and ODs, cause the VTVM to go to 0 almost instantly.

Are you using the VTVM in the DC Volts mode, and self-measuring the voltage drop across the meter due to leakage current ? Why not put the meter in the DC Current measuring mode and measure the leakage current directly ? A series resistance to limit short circuit current is a good idea with that method.

Date: Tue, 28 Nov 2000 12:58:31 -0600
From: "Dr. Gerald N. Johnson, electrical engineer" <geraldj@ames.net>
Subject: Re: [R-390] Re: Capacitor experiences, one more time

If the Fluke input R was equal to that of the Knight VTVM, adding the Fluke in parallel would cut the reading in half, more than just pull it down a little. The Fluke could have an input R quite a bit greater than the Knight VTVM but still finite and would show that "pulling down a little". For large capacitors you can charge the capacitor by shorting the VTVM. The current should stay low once you unshort the meter if the capacitor is good. I suppose the leakage limit might be increased, but if Orange Drops will past my toughest test, why accept anything worse. Now that you've done a few dozen capacitors and found them consistently leaky, is there any need to test more? or do you just prefer to test instead of repair and play with the refurbished hardware? After a series of such tests 15 or 20 years ago I concluded that testing was a waste of time, that my workbench time was far more effective in shotgun replacing ALL paper capacitors (and electrolytics) because that gets me to working hardware faster. E.g. when 95% or more of the tested capacitors were bad, the odds of a good one are too poor to bother hunting for it and then believing it won't go bad soon. As inconvenient as it is to get to the insides of modules in the 390(A) receivers, it makes even more sense to do the project once

and be done with it.

Date: Tue, 28 Nov 2000 14:43:34 -0600
From: "Dr. Gerald N. Johnson, electrical engineer" <geraldj@ames.net>
Subject: Re: [R-390] Re: Capacitor experiences, one more time

20 microamps into the 1/2 meg grid resistor of an output tube changes the bias 10 volts. That's unacceptable... No VTVM of the BA class has a current scale so we have to use the voltage scale to measure current. Its perfectly valid. 1 volt across 11 megohms is 0.09 microamps. And the voltmeter is protected from overload that a current meter might not be when the capacitor shorts while voltage is applied. As for measuring resistance, the leaky capacitor is not necessarily linear as leakage current often rises faster than applied voltage, signs of a voltage breakdown or arcing phenomena. 400 volts 0.1 microamp is 4000 megohms, well above the range of most ohmmeters, even the relatively uncommon megger. Any technique other than VTVM and power supply is just too insensitive to be meaningful. A capacitor that leaks enough to just fail my test can lead to circuit malfunction (to say nothing of further capacitor degradation causing more leakage), especially if on the AGC or a plate to grid coupling capacitor (or plate to mechanical filter).

Its a tough test, but Orange Drops meet it easily and have for over 30 years even after abuse like going through a washer/dryer cycle.

Date: Tue, 28 Nov 2000 20:51:11 -0500
From: "Phil (VA3UX)" <phil@vaxxine.com>
Subject: Re: [R-390] Re: Capacitor experiences, one more time

This pretty well sums my experience too after restoring over 100 antique radios. I use to spend all kinds of time testing capacitors until I realized that I was replacing nearly every one I tested because they were bad or "iffy". Now, I just start on the left side of the chassis and start moving to the right until all the caps have been replaced. There are exceptions of course : The original power supply caps in my 1926 Radiola 18 are still good. But I stare at them every time I turn the thing on.

The old molded mica capacitors had me fooled for a long time. I was told that they were the best of the best at the time and they rarely failed. So early on in the game I would replace everything but those little postage stamp jobbies. One radio I was working on was giving me no end of grief, even after recapping, alignment, etc, etc. I was staring at the underside of the chassis and telling my wife that I'd done everything I could think of but this thing was still acting up like a banshee. She looked at one those molded micas and said "what about that little Chiclet thing there", and tapped it with the end of a pencil. I told her that those ones are never a

problem and it had to be something else. Well the little Chiclet turned into crumbs with one tap of the pencil, leaving the two leads hanging in mid air. After a bad word or two, I plugged in my iron and got back to work.

Date: Wed, 29 Nov 2000 00:03:55 -0600
From: "Dr. Gerald N. Johnson, electrical engineer" <geraldj@ames.net>
Subject: Re: [R-390] Re: Capacitor experiences, one more time

I won't say that mica capacitors are NEVER a problem, but their reliability is far better than the black beauties and waxed blobs of old that they deserve to be tested rather than shot gunned. Besides they tend to affect the alignment of the radio which the paper capacitors shouldn't nearly as much. I'd say my experience is that mica capacitors have about the inverse of the probability of failure as the stripped black beauties. There is the occasional good black beauty and the occasional bad mica. I'd find the micas by circuit trouble shooting rather than by leakage testing, because they are just as likely to be open as to be leaky.

Date: Wed, 29 Nov 2000 19:43:41 -0600
From: "Dr. Gerald N. Johnson, electrical engineer" <geraldj@ames.net>
Subject: Re: [R-390] C 553 10 nF condensator

Some have detected a change in loss when changing from paper to a disk ceramic. Certainly the +80-20 tolerance capacitor is too temperature sensitive to be used. An X7R or COG characteristic is specified for the rest of the ceramic capacitors used in the R-390A. They will stay within 10% over temperature. Any of the Z or Y family of dielectrics (though quite compact) will vary as much as +30/-80% over their operating temperature range. You can't stand that. It appears that the circuit constants expect some inductance from the paper that are not there in a disk ceramic. An orange drop or similar seems to be slightly better. The **contemporary Orange Drops are extend foil with polyester film insulation.** I know similar parts are made in Europe. While there's not a lot of voltage applied, the consequences of failure (destruction of mechanical filters) is so grave that a very high voltage rating can be chosen. I've heard of using two capacitors (twice the value) in series to reduce the odds of a failure. You can find specifications for Orange Drops at AES, Mouser (www.mouser.com) and Digi-Key (www.digikey.com) and probably something like www.vishaysprague.com. Mouser or digikey might have a link to the manufacture's page. I have found it by doing an Alta Vista search on Sprague Capacitor.

Date: Wed, 6 Dec 2000 09:45:43 -0500
From: rbussier@lexmark.com
Subject: Re: [R-390] C 553 10 nF condensator

Dr. Jerry, hi. I recently had to 'restock' my supply of ODs due to some boatanchor refurbs. The monetary shock (even buying the caps in quantities of 100) is like pricing a new car..... That, and your excellent note below, still beg the question:

Why can't one use high quality ceramic discs for most replacements? I can see the need (?) for an OD when used as a coupling cap to prevent temperature caused drift. But what about using the discs as replacements for the bypass positions? The brown tur* * in the R-390A IF deck come to mind. They use .1 Uf to ground everywhere. Not only would the discs be cheaper, but easier to install as well. I understand that back when the old radios were made, the ceramic caps didn't exist. The ceramic caps pass your VTVM test with ease. They also read exactly their value on the LCR bridge. If they have these attributes, shouldn't the use of ceramics be transparent to the circuit? I've been pondering this for years.

To: kurt.brandstetter%teleweb.at@interlock.lexmark.com
cc: bcc: Ron Bussiere/Lex/Lexmark)
Subject: Re: [R-390] C 553 10 nF condensator

Some have detected a change in loss when changing from paper to a disk ceramic. Certainly the +80-20 tolerance capacitor is too temperature sensitive to be used. An X7R or COG characteristic is specified for the rest of the ceramic capacitors used in the R-390A. They will stay within 10% over temperature. Any of the Z or Y family of dielectrics (though quite compact) will vary as much as +30/-80% over their operating temperature range. You can't stand that.

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You can find specifications for Orange Drops at AES, Mouser (www.mouser.com) and Digi-Key (www.digikey.com) and probably something like www.vishaysprague.com. Mouser or digikey might have a link to the manufacture's page. I have found it by doing an Alta Vista search on Sprague Capacitor. 73, Jerry, KOCQ

Date: Wed, 06 Dec 2000 17:15:02 -0600
From: "Dr. Gerald N. Johnson, electrical engineer" <geraldj@ames.net>
Subject: Re: [R-390] C 553 10 nF condensator

I didn't beg the question on ceramic caps. At least some time in the past I've explained their deficiencies. First off, they were available when the 390 and 390a were developed. I KNOW I was building with them then. A bypass is not quite as critical as a tuning capacitor, but is fairly critical especially when there are many stages in the radio. Feedback through a poorly bypassed AGC line is just as effective as hooking a wire to the grid of the first IF and dangling it near the plate of the last IF. The IF is going to oscillate somewhere.

Now 0.1 uf disk ceramics rated at 500 volts are relatively rare and generally have the poorest of characteristics, especially thermal. If you have some, put one on the LCR bridge, then pinch it with your thumb and forefinger (or a couple of them since it will have some more area) and watch the value change just from a bit of body heat. Or heat it to the temperature of a the interior of a tube radio (radiation from the soldering iron will do, a heat gun will do also) and check the value. I learned that the compact ceramics (often made of barium titanate) have a wild temperature coefficient. A long time ago I was trying to build (as a senior design project) a compact tube type radio with single conversion and a crystal filter at about 9 MHz. I stripped a compact radar IF strip leaving a couple tube sockets and cut an opening for the crystal filter. I nestled some dogbone general purpose ceramics into the tube socket pin to tune the IF coils. They resonated beautifully with the stuff cold, but when the tube heat got to them, there wasn't enough range in my slugs to bring them back to resonance.

Another feature of the high dielectric constant (barium titanate) capacitors is that they are piezoelectric. They can act as audio transducers, perhaps to higher frequencies depending on the coating. Try this experiment. Take a fairly compact 0.1 and connect it to a DC VTVM on the 1.5 volt scale. Lay the capacitor on an anvil and tap gently with a wood block or small hammer. The meter will move before the capacitor breaks. That's not a feature of paper capacitors nor of Orange Drops.

The disk ceramic capacitors that are used in the 390A, are specified with a +/- 10% tolerance, including temperature and are not common TV grade parts.

Also in the IF deck, the original paper capacitors were significantly inductive and tended to be close to series resonance at 455 KHz which gave them a lower IF impedance than the same value in a disk because the disk has a far lower inductance. .1 mfd disk ceramics at 500 volts and staying within 10% over temperature will not be a compact as Orange Drops nor inexpensive. Ceramics do make better bypasses for the RF stages and are used there.

Some time ago there was a query on these pages about the poor upper HF performance of some early WW2 tube type radio. The RF tubes and mixer tubes were bypassed with paper capacitors. I suggested paralleling those paper capacitors with 1000 pf disk ceramics and was told that drastically improved the performance of the radio at higher HF frequencies. Proof that the inductance of the paper capacitors was significant.

And disk ceramics aren't original.

Date: Tue, 12 Dec 2000 11:43:48 -0500
From: rbussier@lexmark.com
Subject: Re: [R-390] C 553 10 nF condensator

Jerry, thanks for your usual excellent answer concerning ceramic disc caps. I didn't think about the mechanical vibration thing. I also now understand the temperature explanation also. I sure have learned a lot from you and this group. One last question. I lucked into a fair supply of Sprague yellow tubular caps. Various values and I will check their web-site for more specifics. However, the intended use of these will be for bypass purposes, like replacing the brown tur* * in the 309A IF deck. As you are well aware, the IF deck is loaded with these used as cathode bypass to ground, Unfortunately, the caps I have located are rated at much lower value than the beloved Orange Drops. They are semi-hard and appear to be film/foil inside. They say .xx +/- 20% 100 VDC. They are close to the size of an OD..... Am I correct assuming these would be OK in a bypass situation? If they pass your VTVM test and the LCR bridge test, what types of voltages are likely to be encountered when used as the cathode bypass? Is there any type of high volt testing I could do to see if they will break down? If the 100 VDC rating caps pass the VTVM test at 400 VDC, are they useable?. Would leaving them connected directly to the P/S for an extended time hasten any internal breakdown? On-off cycles / spikes? Thanks for your patience and time.

Date: Tue, 12 Dec 2000 11:32:56 -0600
From: "Dr. Gerald N. Johnson, electrical engineer" <geraldj@ames.net>
Subject: Re: [R-390] C 553 10 nF condensor

100 volt capacitors could be marginal for the long run. From the schematic, it depends on the stage. Some cathodes are locally grounded for DC through a resistor, there the bypass will never see more than a few volts. But the stages on the RF gain control might see 100 volts or more cathode to ground, especially if the RF gain circuit is opened to mute the receiver.

Depending on the dielectric and its imperfections a 100 volt capacitor

that passes a momentary 400 volt test may be OK for a long time or just until next week. Voltage stress on solid dielectrics often gets concentrated by an air gap in the dielectric or some inclusion with a different dielectric constant. In either case the dielectric with the lower dielectric constant sees a greater electric field and it can be greater than the dielectric capabilities leading to micro arcing. That makes noise from the capacitor and leads to failure.

If the capacitor is metalized film, often a trouble spot will burn off the metalization locally and be self curing.

Capacitors are often made with some safety factor in their voltage rating, but how much depends on the maker and their quality control.

I don't think the remaining Sprague companies make the yellow film type capacitors anymore, just the Orange Drops. But I haven't read their recent catalogs closely.

I have some of those yellow Sprague capacitors and haven't noticed any problems when using them within their ratings.

Continuous testing with voltage applied would show up more failures than a short test, spikes would always increase the odds of voltage breakdown. When making such a test it would be beneficial to hook up an audio amplifier or scope across the capacitors to listen for clicks and frying sounds, indicators of micro arcs.

You would be more productive shoveling snow for a couple days to earn the money to buy capacitors with the proper ratings and would have far better assurance that they would continue to serve well for decades.

Otherwise you are suggesting to fix a Mercedes truck with Chevette sized parts.

Date: Tue, 12 Dec 2000 15:38:46 -0500
From: rbussier@lexmark.com
Subject: Re: [R-390] C 553 10 nF condensor

I have also obtained a large quantity (new) of the rectangular "WIMA" caps. These came out of switching P/Ss. (That's what they are called in the Antique Electronics catalog. These are very nice looking and have a pretty high voltage rating.

Non-polarized and rated at 275V-X2, whatever that means. Probably the AC voltage with 1.4 (X2) being the DC rating?? Anyway, I have seen some stamped '275 VAC/400VDC'. They easily pass your VTVM test and are

right on, when measured with the LCR bridge. Look like a small plastic box, potted with resin on the open end. Any comments?

Date: Tue, 12 Dec 2000 21:05:30 -0800
From: Robert Tetrault <tetrault@teleport.com>
Subject: Re: [R-390] C 553 10 nF condensor

WIMA is one of the best Deutschlander brands around, but not well distributed here in the New World. The markings suggest they are line rated, UL type caps suitable for across the line bypassing, and eminently suitable for anything you can fit them into that could use a film type cap

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Date: Tue, 12 Dec 2000 23:14:35 -0600
From: "Dr. Gerald N. Johnson, electrical engineer" <geraldj@ames.net>
Subject: Re: [R-390] C 553 10 nF condensor

A capacitor made of foil and film will always have some air gap between the foil and the film and that air gap has a lower breakdown strength than the film and so when an excess voltage is applied that air gap will break down creating noise and local heat to add damage to the adjacent solid dielectric. Use them within their ratings for longer life.

Date: Mon, 11 Dec 2000 22:40:42 -0500
From: "Barry Hauser" <barry@hausernet.com>
Subject: Re: [R-390] C-609 Polarity

This is a "duh" question. I have here a '60 EAC audio deck with a C-609 that doesn't look so good -- tossed its cookies (or upchucked its chads, so to speak, no offense). It's a little metal rocket shaped electrolytic -- 8 mfd at 30 vdc - mounted on the PC board. As a temporary, diagnostic measure, I also have the closest thing to be found at RS -- a 10 mfd, 35 v electrolytic, which I'd like to sub in to see if it restores some functionality to this rig.

What's the polarity on this thing? I can't read anything on what's left of the original.

According to the schematic, one end is connected to pin 3 of V601A, the first AF amp an the other to ground, in parallel with R604, a 1200 ohm resistor.

Ordinarily, I'd assume the minus side of the new electrolytic would go to ground. Is that right? Schematic doesn't show any polarity. Was this a non-polarized electrolytic?

BTW - The receiver is partially functional, but output is very low and the

audio meter doesn't deflect regardless of the setting of the switch or line level pot. Would a failed C609 do that? Not much carrier meter deflection either -- hardly any. AGC-related?

Date: Mon, 11 Dec 2000 23:30:53 -0600
From: "Dr. Gerald N. Johnson, electrical engineer" <geraldj@ames.net>
Subject: Re: [R-390] C-609 Polarity

That was a wet tantalum. One of those capacitors that should have been replaced before it tossed its acid out into the radio. The outside case is negative. A solid tantalum would be the best replacement. 8 at 30 or 35 volts is a fairly common value.

Date: Tue, 12 Dec 2000 02:13:20 -0500 (EST)
From: Norman Ryan <nryan@duke.edu>
Subject: Re: [R-390] C-609 Polarity

The negative end of C609 points toward the chassis wall. Tantalums are polarized. Dunno if the electrolytic will work like a tantalum. If I understand right, the tantalum was chosen because it fits in the narrow space between circuit board and frame whereas an electrolytic wouldn't. So maybe it's OK to try out an electrolytic. Purist that I am, I'd get a dry tantalum eventually. Sounds like there's more to be done on your set. Carrier meter doesn't depend on a well functioning AF section.

IF deck OK? Got a working spare IF deck to subsitute? Checked the tubes? Looked for out of spec resistors? Recapped? Measured resistances to ground?

Date: Mon, 01 Jan 2001 14:25:28 -0600
From: Dallas Lankford <dallas@bayou.com>
Subject: [R-390] On Replacing Capacitors

I have seen it said that one should replace certain capacitors in the R-390A, especially some of the paper capacitors in the IF deck, as a matter of routine maintenance. However, Mr. R-390A and I have never encountered a bad paper capacitor in an IF deck (or anywhere in an R-390A for that matter), and I have about 10 overhauled R-390As under my belt, while he has maybe 10 times that many. So it appears that those capacitors should not be replaced unless measurements indicate they are defective. On the other hand, the C609 electrolytic on the PC board in the IF deck is frequently leaking electrolyte, and if so, should be replaced.

But then I have never seen a defective 100 pF mica C327 in the RF deck. Furthermore, the peak-to-peak voltage at J221 is not 3 volts as reported elsewhere, but rather 10 volts (as measured by a 10 X scope probe at a T

connector used to measure the voltage at J221) for the R-390A tuned to any of bands 0 - 7. So it appears that capacitor should not be replaced unless measurement indicates it is defective.

I generally operate under the rule "if it ain't broke, don't fix it." There have been a few exceptions along the way. I once had an IF deck which had an intermittent 10 dB loss of signal. I tried everything, including removing the IF cans to see if the previous owner had removed the Q-spoiling resistors. Nope. So in desperation I replaced all the paper capacitors. Maybe? Nope! Still there, the intermittent loss, that is. So I started rechecking everything I had done before. And when I removed the IF cans again, and looked closely under bright light, there is was. The dumbo had cut one resistor lead for each IF transformer, but not the other leads, and had left the cut ends almost touching. The resistors were replaced and the intermittent was gone. Except for the electrolytic in the audio deck (see above), all of the bad capacitors Mr. R-390A and I have encountered were mostly red but sometimes green (silver) micas. I found one once in the noise limiter circuit, and another in the AGC signal path. But by far the bad micas are most commonly found in the tuned circuits of the oscillator deck.
You may have a bad one in your R-390A and not even know it. They can be easily found by peaking each of the ceramic trimmer capacitors on the oscillator deck. You don't even need a signal generator. Merely tune in your favorite CAL marker and adjust the each ceramic trimmer in turn for each band with a small screwdriver. If you do not get a double peak, but only a single peak (as the trimmer is rotated through 360 degrees), then you have a bad mica in in your osc deck for that band. The bad trimmer is paralleled across the lugs of the ceramic trimmer. So you merely (!!) remove the RF/osc deck, replace the bad mica (a little practice on a junker osc deck would probably help), and put everything (!!) back together.

Date: Mon, 01 Jan 2001 16:32:48 -0500
From: Jim Miller <jmille77@bellsouth.net>
Subject: Re: [R-390] On Replacing Capacitors

I'm a newbie restoring an old SW R-390A. I have read that there is a "killer" capacitor (C553 ,01 mf if I recall correctly) ahead of the mechanical filters, a DC blocking cap. that is rated at too low a voltage. If it fails, it can apply B+ to the mechanical filters and take out whichever filter is currently selected (I would guess a couple hundred $$ a filter if you can find them now ...I would hate that to happen again). So I looked into my IF deck and lo and behold it looked like sometime in its history this radio (in depot repair maybe?) had had all its filters replaced and a new capacitor soldered in, but it was the same low voltage rating! So this kind of failure does indeed occur! Hemce I immediately followed the suggestions seen on Chuck Rippel's web page and others, and replaced it

with a 600V Orange Drop. It is an easy task, I recommend it... better to be safe than sorry. 73 N4BE

Date: Mon, 1 Jan 2001 16:40:24 -0500
From: "Ronald Reams" <wa4mjf@worldnet.att.net>
Subject: Re: [R-390] On Replacing Capacitors

This is true, that cap took out filters in my Motorola.

Date: Mon, 01 Jan 2001 17:02:12 -0600
From: "Dr. Gerald N. Johnson, electrical engineer" <geraldj@ames.net>
Subject: Re: [R-390] On Replacing Capacitors

Perhaps your criteria for leakage is looser than mine. I won't accept leakage greater than .1 microamp with rated DC applied. Dallas, what is your criteria for leakage limit? I figure 1 microamp to an audio output tube changes the bias half a volt and that it may cut AGC voltage in half so I don't consider allowing greater leakage.

Date: Mon, 01 Jan 2001 17:28:21 -0600
From: Dallas Lankford <dallas@bayou.com>
Subject: Re: [R-390] On Replacing Capacitors

Of course you should replace C553 (if I recall correctly). That was pointed out long before web pages in The Hollow State Newsletter. But except for it and the electrolytic in the audio deck, replacing the others is a waste of time.

Date: Mon, 01 Jan 2001 18:07:40 -0600
From: Dallas Lankford <dallas@bayou.com>
Subject: Re: [R-390] On Replacing Capacitors

> Perhaps your criteria for leakage is looser than mine.

Why are you suggesting criteria for me? I don't have a criteria as far as I know.

> I won't accept leakage greater than 0.1 microamp with rated DC applied.

What capacitors are you referring to? And how do you measure their leakage?

> Dallas, what is your criteria for leakage limit?

I would be glad to answer your question if I understood it.

> I figure 1 microamp to an audio output tube changes the bias half a volt and that it may cut >AGC voltage in half

1 microamp to an audio output tube ... may cut AGC voltage in half? I don't understand.

> so I don't consider allowing greater leakage.

What is this leakage you are talking about, and how do you measure it? I want to know. The only changes in AGC voltage in an R-390A that I have observed were due to grid emission (and the changes were only a few volts positive, if I remember correctly, under no signal conditions). Oh yes, and that bad mica in the AGC signal path.

Date: Mon, 01 Jan 2001 18:22:15 -0600
From: "Dr. Gerald N. Johnson, electrical engineer" <geraldj@ames.net>
Subject: Re: [R-390] On Replacing Capacitors

I check capacitors with a power supply and VTVM. 11 Megohm impedance on the VTVM. I connect meter and power supply common together, I connect the capacitor under test between the power supply positive and the meter positive (usually a probe). I set the VTVM to a DC voltage range at least as great as the capacitor voltage rating or the power supply limit which ever is lower. I bring the power supply voltage up. The VTVM will go way up scale. As the capacitor charges through the 11 Megohms, the voltmeter reading goes down. I change ranges until I'm on the 1.5 volt range with a good capacitor. With my unregulated supply I can only get down to about 1 volt across 11 Megohms, for just under .1 microamp leakage. Orange Drops pass that test, old molded and waxed papers, whether used or NOS generally fail miserably.

> 1 microamp to an audio output tube ... may cut AGC voltage in half? I don't understand.

I'm talking about two common but separate situations in receivers. One is that leakage in the coupling capacitors to audio stage grids can change the output tube grid bias significantly leading to audio distortion and tube damage. The other is that since there are Megohms of series resistor for time constant resistors in AGC circuits, a microamp of AGC time constant or bypass capacitor leakage can cut the AGC voltage applied to IF and RF stages leading to overdrive of the last IF and distortion on the detected signal. When normal AGC voltage is only -7 volts a few volts positive from grid emission seriously changes the AGC action of the receiver and shortens the lifetimes of adjacent IF/RF tubes by causing them to draw excess plate current. Mica capacitors can fail but not as often as old paper capacitors. It is far more common in my experience to find that NO paper

capacitors in a 50s vintage receiver will pass my leakage tests.

Date: Mon, 01 Jan 2001 20:06:29 -0600
From: Dallas Lankford <dallas@bayou.com>
Subject: Re: [R-390] On Replacing Capacitors

I didn't understand your your description of your test setup above, and it seems there was not enough information to reproduce it, so I made up my own. I used a 0-30 VDC supply set to 20 VDC. However, two 9 volt batteries would work just as well. The power supply was connected in series with nine 10 Meg ohm resistors (which should be available at Radio Shack), and in turn connected in series with a 1 Meg ohm resistor. I connected my DVM across the 1 Meg resistor and set it to the DC volts range. An AES yellow wrap measured 0.005 uA. Then I clipped a Vitamin Q style paper cap and an encapsulated paper cap from a junker R-390A IF deck which had been generously given to me by Mr. R-390A. The Vitamin Q measured the same as the yellow wrap, namely 0.005 uA. The encapsulated paper was a bit worse at 0.05 uA. Based on this small sample, and my observations and tinkering with R-390As for about 20 years, I would continue to say that it is a waste of time to replace paper caps in an R-390A (unless, of course, it has been determined to be defective by some measurement or test).

<snip> Mica capacitors can fail but not as often as old paper capacitors.

Not in my experience and in the experience of Mr. R-390A.

> It is far more common in my experience to find that NO paper capacitors in a 50s vintage receiver will pass my leakage tests.

I am batting 2 sucesses out of 2, or so it seems.

Date: Mon, 01 Jan 2001 20:17:22 -0600
From: Dallas Lankford <dallas@bayou.com>
Subject: [R-390] Cap Leakage P.S.

Dunno why I used nine 10 Meg ohm resistors. One works fine. I guess it was the excitement of the chase.

Date: Mon, 01 Jan 2001 22:17:41 -0600
From: "Dr. Gerald N. Johnson, electrical engineer" <geraldj@ames.net>
Subject: Re: [R-390] On Replacing Capacitors

Dallas, what is that you don't understand about my circuit? My VTVM is 11 megohms input Z. That's the only R in my circuit. I run the power supply up to 400 volts for a 400 volt capacitor, 450 volts for 600 volt

capacitors (simply to not blow the 450 volt electrolytics in my variable voltage power supply). As I understand your circuit you limit current with series resistors so that not even a shorted capacitor would show significant leakage. Also testing 400 volt capacitors with only 20 volts is not a valid test because leakage is often voltage sensitive. I say its a waste of time to TEST 50s vintage capacitors, especially molded oiled paper because they are essentially all leaky. Better to simply replace them and save the testing time.

Date: Mon, 01 Jan 2001 23:18:04 -0600
From: Dallas Lankford <dallas@bayou.com>
Subject: [R-390] More Capacitor Leakage

While eating supper it occurred to me that my 20 VDC test voltage might not be representative. So I borrowed a little +240 VDC from the B+ fuse holder and ran my tests again. The AES yellow wraps gave less than 0.001 uA. Ditto for the Vitamin Q. The encapsulated paper cap gave about 5 uA. I cut out several other encapsulated paper caps from the junker deck, and they all gave the same 5 uA leakage at +240 VDC. At this point it is difficult to proceed further, because not all R-390As are the same. There are none of these encapsulated paper caps in the one EAC IF deck I looked at tonight, and only a few in another. Also, it is not clear if all encapsulated paper caps are leaky. I'll take one out of an EAC IF deck tomorrow and test it. Furthermore, I need to find out what test voltage others use to measure capacitor leakage so I can compare my results with theirs. I suppose individuals can determine that on a case by case basis. Finally, whether a cap is leaky or not seems to depend on the applied voltage. C517 in the IF deck seems to be one such cap. Although it is one of the encapsulated paper caps in my junker IF deck, the operating voltage is low, so it is not leaky. I'll have to read my manual to determine the status of the others.

Date: Tue, 2 Jan 2001 02:22:47 -0500
From: "Barry Hauser" <barry@hausernet.com>
Subject: Re: [R-390] More Capacitor Leakage

Nice to hear, uh, read, from you again. :-) As you no doubt know, there are a number of brands of the molded paper caps -- the Sprague Black Beauties, but then there are grays, browns/tans, and maroon ones (don't know who made those). Some have a full molded look, others are smoother cylindrical shapes as if extruded, but rough ends (usually the browns and grays). Then there are the red Cornell Dublier's, which have (usually) yellow imprinting and no color bands. I wonder if there's a difference in quality 35-45 years after the fact?

There's also a variety of the metal glass sealed type -- the Vitamin Q's, but

also the West-Caps, two of which .01/300v I just replaced in a '60 Stewart Warner. They both pass the crude ohmmeter test -- even the C608 that got partially eaten by the bad tantalum next to it.

Aside from brand and age, I suppose another factor is use vs. storage and conditions thereof. Apparently, these don't benefit from disuse. I once thought those glass sealed mil spec jobs were the apex of capacitor-dom, and maybe they were, but then I found a Good-All 2.0 Mfd/200v that I picked up surplus in the 60's and was sitting in a parts bin for 30 some odd years. The metal tubing was split longways and unsprung -- not on a joint. The glass seals are still intact, the solder joint around the endcaps failed. The insides look good still. Maybe I'll test it.

Anyway -- I have an odd problem on this S-W. The audio practically mutes to nothing when I turn the noise limiter OFF. Any clues? I haven't started probing yet, so I guess I'm being lazy, huh? All the tubes test well above the TV-7D/U chart values.

Date: Tue, 2 Jan 2001 06:35:42 -0500
From: "Walter Wilson" <wewilson@knology.net>
Subject: Re: [R-390] More Capacitor Leakage

The following is from Chuck Rippel's web page, list of common problems:

Problem: Low Audio, Distorted Audio, or No audio. When Local Gain is advanced to 9-10,audio is barely perceptable. Audio returns to normal when the Limiter is turned on. This problem exhibits similar symptoms of other posted Limiter problems. This problem appeared on an EAC/Hammarlund R-390A while operating.

Discussion: C532, 100pf (connected from Pins 6 and 7 of V507 to ground) is used to supress any remaining IF elements in the signal while allowing audio frequencies to pass into the Limiter circuit. This capacitor had failed in a resistive state under operating conditions (read open with an ohmmeter). The additional load of this capacitor on the Plate/Grid of V507
(B section) caused the voltage at the Plate/Grid to be only about 22 volts as compared to the nominal 78 volts as shown in the technical manual. This causes V507B to cutoff. When the Limiter was turned on, the plate voltage was sufficient to allow conduction due to the re-biasing of the tube in the Limiter-On state.

Solution: Replace C532 with a 100pf 1KV disc ceramic. Note, this capacitor is located against the bottom of the chassis at the base of V507's socket and is very hard to get to.

Date: Tue, 02 Jan 2001 07:17:53 -0600
From: Dallas Lankford <dallas@bayou.com>
Subject: [R-390] On Capacitor Replacement

Let me preface these remarks by saying that it has been believed since it was discussed in the early issues of The Hollow State Newsletter, over 10 years ago, that then infamous mechanical filter killer in the IF deck, C553, should be replaced before you use that IF deck. The 8 ugh electrolytic in the audio deck should also be replaced if it shows any signs of electrolyte leakage. I replace C553 immediately in any R-390A that passes through my hands, before I even turn it on. However, I am unconvinced that other capacitors in an R-390A should be replaced unless there is some justification for doing so, such as departures from tube pin voltage and resistor charts, obvious malfunctions, and the like.

The discussion of capacitor leakage, though it has not been accurately defined, has been quite interesting. For the purpose of discussion, let us call a capacitor leaky which has a current of greater than 0.1 uA with 200 VDC across the capacitor when the capacitor is operating under 200 VDC load. In my EAC IF deck there are 4 encapsulated capacitors, which are possible leaky (though I don't plan to remove them to find out), namely, C529, C533, C541, and C545. All are bypass capacitors of one kind or another (screen bypass, cathode bypass, B+ bypass). Suppose they are leaky, and suppose they draw 5 uA with 200 VDC applied (as I measured for other encapsulated capacitors). That is equivalent to 40 Meg ohms. So I asked myself, suppose the capacitors were not leaky, and I installed 40 meg ohm resistors in parallel with them. Would that have any measurable or observable effect? I think not. Tube pin voltages and resistances would not change. And I can't think of any other changes which would lead to an observable effect.

There may be capacitors in the R-390A where leakage degrades performance, but I do not know of any. However, technical details aside, common sense tells us that there are few, if any, leaky capacitors in R-390As that degrade performance because so many of us have well-functioning R-390As. A (1956) Motorola that I overhauled an sold to a friend here in town has all its encapsulated caps, except, of course, for C553. If you compare it to my EACs, you will find no difference in performance, audible or measurable, between them. Well, that's not quite true. It has the "won't turn off" problem, and he won't bring it by for me to replace the FUNCTION switch.

Date: Tue, 02 Jan 2001 07:52:10 -0600
From: Dallas Lankford <dallas@bayou.com>
Subject: Re: [R-390] On Replacing Capacitors

Did you mention voltages before? If so, I missed it. However, R-390As have only a 240 VDC B+, so you should not test at voltages higher than 240.

> As I understand your circuit you limit current with series resistors so
> that not even a shorted capacitor would show significant leakage.

That is not true, and you know it.

> Also testing 400 volt capacitors with only 20 volts is not a valid test because leakage is often voltage sensitive.

Why not, if it has only 20 volts, or thereabouts, applied? And testing R-390A caps at 400 volts, as you said you do, would not give a correct value for in-circuit leakage, since the maximum voltage they will see is 240 VDC.
> I say it's a waste of time to TEST 50s vintage capacitors, especially molded oiled paper >because they are essentially all leaky. Better to simply replace them and save the testing >time.

Of course, it wouldn't make any sense to remove a capacitor, for whatever reason, and then to put it back in. You still have not convinced me that I should remove all the paper caps from my R-390As and replace them with Orange Drops. Orange Drops are ugly anyway.

Date: Tue, 2 Jan 2001 09:35:33 -0500
From: rbussier@lexmark.com
Subject: Re: [R-390] On Replacing Capacitors

Dallas, I use Dr. Jerry's method (which I have seen described in several publications), and it is a real eye opener. Yesterday, I finished recapping a spare IF deck for an 390A. Every brown tur* cap in it, leaked very badly. Sure these are mostly only bypass to ground, but still, it all adds up. None of the "vitamin Qs" were leaky, so they were left in the deck due to the difficulty in general, of digging them out. In addition, I have just refinished restoring several dozen pieces of vintage test equipment. Every cap in all of this equipment was checked. If the cap is a tubular and has the color coding rings, like a resistor, odds are 99.99% it's nfg. If it's a wax cap, I don't even check them, just replace them. Most of this equipment was had for a song, because of 'problems', which turned out to be a few bad tubes, but mostly bad caps. I was refreshing my Drake TR-6 and found a couple of cracked leaking caps in the noise blanker. I now have several milk jugs full of the old, leaky caps. Orange Drops are so much better, you have to test some of the old waxy caps side by side, to believe it. When you put 400 VDC across a cap and it drops >200 VDC, it is going to affect lots of things.

Date: Tue, 2 Jan 2001 11:02:24 -0500
From: rbussier@lexmark.com
Subject: Re: [R-390] On Replacing Capacitors

Dallas, while I cannot argue with your 'don't fix something that's not broken' theory, great strides have been made in the efficiency of caps since the 50s and 60s. Taken individually, a few micro or milliamps of leakage here and there may not be significant (and may be included in the circuit design) but when virtually all the caps in the 390a are leaking, that cannot be an asset to the performance of any device. As I mentioned, I use the VTVM / power supply test method. I recently restored several HP 608X signal generators. The oldest one had the black color coded 'beauties' in it. Every one was cracked and leaking. The newer HPs had the Sprague black caps which all tested perfect. 2 generators slightly different vintage, one was drifty and had low output. It now functions perfectly, all it took was a wholesale cap swap. The ones in the IF deck are actually very easy to test. They have one end tied to a ground lug, all you have to do is remove a screw to isolate it. Next up are the 75A-4 and the 51J-3.

Date: Tue, 02 Jan 2001 10:55:03 -0600
From: "Dr. Gerald N. Johnson, electrical engineer" <geraldj@ames.net>
Subject: Re: [R-390] On Capacitor Replacement

A capacitor that has 5 microamps of leakage is dissipating power which raises its temperature and generally increases its leakage. Those can cascade. Small drops in screen voltage cause small drops in stage gain. Over several stages that can lead to poor sensitivity. And the increased current through the screen dropping resistors can lead to them drifting in value faster. A low voltage check of a capacitor (such as an ohmmeter) is not as tough on the part as a high voltage (limited by the rated voltage) because the leakage is often temperature sensitive and often shows some breakdown phenomena so that the leakage increases more rapidly than the applied voltage. When my tests and others experiences shows that the molded paper capacitors are most likely to be excessively leaky it is far easier to replace all in a modular receiver like the 390(a) than to trouble shoot as they fail.

Date: Tue, 02 Jan 2001 10:55:06 -0600
From: "Dr. Gerald N. Johnson, electrical engineer" <geraldj@ames.net>
Subject: Re: [R-390] More Capacitor Leakage

My original post I said use the capacitor rated voltage.

AES yellow wraps and good Vitamin Q can be pretty good capacitors. Far better than the color striped molded capacitors that were used in many production runs of the 390(a).

Date: Tue, 02 Jan 2001 12:08:59 -0600
From: Dallas Lankford <dallas@bayou.com>
Subject: Re: [R-390] On Capacitor Replacement

Since I have never had a molded paper capacitor fail in 20 years, it never occurred to me to replace them all, except for that one IF deck with the intermittent which turned out not to be a capacitor.

Date: Tue, 2 Jan 2001 13:36:51 -0500
From: "Warren, W. Thomas" <wtw@rti.org>
Subject: [R-390] Capacitor replacement

Comments invited on how to do capacitor replacement in the 390A so far as the actual mechanics are concerned. In a perfect world (and with the hand-eye coordination of a practiced neurosurgeon), it's best to use solder wick to remove as much solder as possible, then unwind the normal one-and-one-half lead wraps, then put in the new capacitor, one-and-one-half wraps again, and solder. In those tight places (even with solder guards) this is very much a non-trivial process with lots of burned insulation, excessive heat on very old components, broken pins, excess flux to clean off, burned and lifted platings, etc, etc, etc.

Two questions:

1. Has someone discovered a little crimping tool and connectors (for mechanical stability) so you can simply clip out the old capacitor, then crimp in the new one to the old leads, then re-solder over the crimping connector (thus electrical connectivity), and then possibly re-solder the old lead at the original socket connection to be sure that connection hasn't crystallized after the many years?

2. How about clipping out the old capacitor, then physically wrapping (one-and-one-half turns if you please) the remaining leads over the leads of the new capacitor and then re-soldering? That seems to be to a moderately conservative process but obviously doesn't look as good as the ideal process. My understanding is that on some of the EAC units, some of the tube sockets and components were built on a manufacturing jig external to the actual chassis and then installed in the chassis. That speaks for the space being so tight that even the very practiced ladies who did this kind of work on a daily basis not having enough manual dexterity to get into the tight spaces of even a partially built unit. Secondly, I picked up somewhere that the Government wouldn't allow crimped connections along a wiring run (this may be due to lousy crimps 40 years ago or over-engineered specs perhaps for battleship installations where vibration is indeed a big deal). Thirdly, what did the Government manuals

dictate as a way to replace zapped components? So what is the preferred approach?

Date: Tue, 02 Jan 2001 13:14:24 -0600
From: "Dr. Gerald N. Johnson, electrical engineer" <geraldj@ames.net>
Subject: [R-390] Re: Capacitor replacement

I prefer cutting out the old capacitor with flush cutting very pointed diagonal cutters. Then hooking the new capacitor lead around the post a half turn or across the socket lug or through the hole. Then if its soldered well it will stay connected as long as needed except maybe when in or near a large gun turret. The idea of one-and-one-half lead wraps is old fashioned, makes repair difficult and hides sloppy soldering with mechanical joints that can become intermittent in the long haul making for very difficult trouble shooting.

One could leave a bit of lead and use a tool kind of like a wire wrap tool to make a coil in the new capacitor lead (I think Sprague once sold such a tool next to their crimps for capacitor replacement that used to come with certain eras of replacement capacitors) that would solder over the original lead.

Military prefers crimps to solder because good crimps (made with a ratcheting tool to insure a complete crimp) last far better under vibration that soldered connections. That is because solder almost always wicks into the strands of stranded hook up wire making it stiff near the joint where bending is the greatest and so makes the stranded wire break. Splices, crimped or otherwise in a cable are a real pain to find and fix and would be frowned upon. We are rich, we don't need to extend wires... Modern automotive cabling can be nightmarish with all the hidden splices and taps inside cable bundles.

Date: Tue, 02 Jan 2001 13:42:31 -0600
From: "Dr. Gerald N. Johnson, electrical engineer" <geraldj@ames.net>
Subject: Re: [R-390] On Capacitor Replacement

I've not found more than 5% GOOD molded paper capcitors from the 50s and 60s in the past 20 years, so I tend to figure they all need replacement. Oil and paper makes a not so great capacitor compared to plastic films.

Date: Tue, 02 Jan 2001 16:09:53 -0600
From: Roy Morgan <roy.morgan@nist.gov>
Subject: Re: [R-390] Capacitor replacement

.. it's best to use solder wick to remove as much solder as possible,.....

Not in my opinion it isn't.

>1. Has someone discovered a little crimping tool .....

Yes. Sprague Company had this solved by 1947 or so. They sold little spirals of tinned wire along with their capacitors. You did just that: clip out the old component, slip the spiral over the remaining leads, slipped the shortened-to-length leads of the new cap into the spirals and soldered. One-two - you were done. This method was apparently well received by radio repair shops where saving a bit of time on each set made the difference between staying in business or going bankrupt.

>2. How about clipping out the old capacitor, ...

Fine if you don't have The Little Tool to make it oh, so easy. (read on) The Little Tool I propose is made thusly:

Materials needed:

1) One quarter inch or 5/16 inch diameter threaded metal standoff.

2) One screw to fit the standoff

3) One or more metal phonograph needles, or the shank of a drill the same size. The diameter should be just larger than the leads normally encountered in radios.

4) One wooden tool handle such as small files are supplied in, or simply a dowel 3-1/2 inches long by 3/4 inch diameter. A plastic handle from a screwdriver will work but wood is more satisfying. If you used a dowel, taper one end a bit and break the sharpness of the other end. Drill the tool handle or dowel to fit the standoff, and epoxy the thing in the hole with half its length free. On the end of the metal standoff, file a groove just at the edge of the threaded hole. With the screw, fasten the phonograph needle or piece of drill bit down securely. Extend the blunt end of the needle, and grind off the sharp end on a stone if you care to. End of tool construction.

To use, simply cut out the old defunct component from the radio and gauge the location of the needed spirals on the new component. You may want to scrape a bit on the old leads if the radio is particularly antique or if MFP coatings have been used. Put the turns into each lead of the part by holding the part next to the tool and winding with your needle nose pliers. Clip the extra length, bend to the right orientation, slip into place and solder.

Date: Tue, 02 Jan 2001 16:18:08 -0600
From: Dallas Lankford <dallas@bayou.com>

Subject: [R-390] EAC Caps

My curiosity got the better of me. I removed one yellow wrap and one brown molded cap from one of my EAC IF decks for testing. I did not test these at their maximum ratings, as some do, because I have read that it is not a good idea to operate components at their (maximum) ratings. Instead, I continued to test in the 200 - 240 VDC range I have been using (my initial tests at 20 VDC were just to get the hang of things). The brown molded from the EAC IF tested 1 uV at 229 VDC, about 5 times better than the brown molded caps I tested from the junker IF. The yellow wrap from the EAC IF tested about 0.02 uA at 240 VDC, about the same as the AES yellow wraps, which are metal film.

The brown molded caps with 1 uA leakage don't pass the 0.1 uA standard used by some, but they seem fine to me, being equivalent to 229 Meg ohm resistors. And the yellow wraps (at least the one I tested) pass the 0.1 uA standard, so I don't think we should replace them. Ditto for the Vitamin Qs.

I took out an EAC audio deck, but there weren't any brown molded caps. So I don't think there is any argument about replacing caps in the EAC audio deck.

Then I looked at one of my EAC RF decks. There was one molded cap, C275. If you have a molded cap there, and it makes you feel better, replace it as preventive maintenance. I can go along with that because the RF deck is tough to trouble shoot, and a chore to remove and replace.

Well, it has been fun discussing these things. But classes resume at the university tomorrow, and I need to finish grading a set of calculus exams, so my play time is over for a while.

Date: Tue, 02 Jan 2001 16:25:36 -0600
From: Dallas Lankford <dallas@bayou.com>
Subject: Re: [R-390] On Capacitor Replacement

Are you talking about R-390As? I rebuilt an SP-600 once with those "black beauties" that probably had no good molded caps in it. Of course I replaced all the capacitors in it.

Date: Tue, 02 Jan 2001 17:09:53 -0600
From: "Dr. Gerald N. Johnson, electrical engineer" <geraldj@ames.net>
Subject: Re: [R-390] On Capacitor Replacement

Many 390(a) were built with molded capacitors that all check out bad.
It saves a lot of work to just replace them without question.

Date: Tue, 02 Jan 2001 19:06:35 -0500
From: "Phil (VA3UX)" <phil@vaxxine.com>
Subject: Re: [R-390] Capacitor replacement

Yep ! I've done this hundreds of times where it made sense to do so (ie. it didn't make any sense to spend 45 minutes trying to change a cap lead for lead in tiny cramped quarters). Clip the old cap leads and turf the cap. Leave enough of the originally soldered-in-place leads so that you bend a little "eye hook" in it the ends of them. Bend hooks in the ends of the new cap leads, thread them through the previously made eye hooks, crimp as best you can, and solder. All done. With RF cicuits of course, lead length can matter. This procedure usually results in increased lead length compared to the original. So far I haven't had any operational or performance problems due to the slightly increased lead length. But I'm aware that it is a possibility.

Date: Tue, 02 Jan 2001 19:28:28 -0500
From: Bill Riches <briches@dandy.net>
Subject: Re: [R-390] Capacitor replacement

.....a little crimping tool .....

Several years ago when I was repairing TV sets there were things called "quigs". They were solder covered wire that resembled a small spring - the new part's lead and the clipped wire end were inserted into each end - touch it with a hot iron and presto chango - no more broken tube socket pins. Not beautiful but they worked. Maybe Mouser or MCM may have something.

Date: Tue, 2 Jan 2001 20:26:29 -0500
From: "Barry Hauser" <barry@hausernet.com>
Subject: Re: [R-390] Capacitor replacement

One technique that can work in many cases is to use a desoldering bulb and flush cutters to prep the joint. First, clip the old cap/resistor lead as close to the joint as possible with flush cutters. I think Dr. J just mentioned using these. Even though they were intended for trimming leads flush on PC boards, they are preferred for this work on point-to-point wiring. They tend to be sharper, and it's possible to get the blade closer than it would with regular wire cutters. Also -- very important -- there is more of a smooth slicing action, without that uncontrolled snapping of the regular cutters which can result in damage to terminals. (Actually, there are some SS components that can be damaged internally by the physical shock of wire cutters and the preferred method is to solder them into the pc board first and then trim.)

First, re-tin the iron and pull out as much solder as you can do quickly so as not to overheat the joint. I find the simple desoldering bulb a bit easier to handle than the spring loaded solder "pullit" which has quite a bit of recoil and needs to be re-cocked for each try.

Second, use the flush cutters again to cut into the now discernable turns of the remaining lead(s). Reheat the joint and tease away whatever debris is there. Don't try to get it all if it takes too much straining, just enough to clean up the terminal post a bit or open a hole in a tube socket or switch terminal. Use a broken wooden swabbie stick or those coated soldering tools if needed.

Third -- install new component, tolerating whatever remaining curls of the old one that wouldn't come out above.

Of course, this assumes that you can reach the joint. If not, the splicing method is preferable to ruining terminals. You can use some spagetti or teflon tubing to dress it up and make it look like it was "supposed to be that way". ;-)

Date: Tue, 2 Jan 2001 21:07:29 -0500
From: "Tetrode" <tetrode@sprynet.com>
Subject: Re: [R-390] Capacitor replacement

.....a little crimping tool .....

I try to make a fresh connection whenever I can, but I remember there was one spot in the 390A IF deck where getting to the actual terminal would have been most unpleasant and not worth the effort, so I used a suggestion I picked up here to make a solderable splice. All you need to do is get some bare hookup or small buss wire of suitable size and wrap a few turns around a small drill bit, or even the original capacitor leads (as a form). Remove it from the form, and now you can slip that over the wire ends to be joined, crimp it a little if you want and solder it up! Just make sure the metal is prepped nice and clean before soldering.

Date: Wed, 3 Jan 2001 01:12:54 -0500 (EST)
From: Norman Ryan <nryan@duke.edu>
Subject: Re: [R-390] Capacitor replacement

I've never tried solder wick, but get pretty good results with a vacuum operated solder sucker like the Weller DS-600. The joint gets so "dry" that you can easily lift and unwrap the wire from the terminal. I got a really nice deal on a good used unit. They cost an arm and a leg new otherwise. The new cap or resistor goes in and the leads are wrapped in the usual 1-

1/2 turns way. With patience you can get results that look like new. I also use surgical clamps or copper alligator clips as heat sinks on the leads of replacement carbon comp resistors.

Be careful handling those stiff coated steel leads like you find on some orange drop type caps. In this case skip the 1-1/2 turn method and pre-form a simple hook. Go easy around tube pin connections and the itty bitty terminal on those insulating standoff posts. Admittedly, this takes time, but it is recreational rather than remunerative work. Besides, you've seen how I fuss over detail at my day job in the Chapel. :-)

Date: Wed, 3 Jan 2001 06:47:55 EST
From: DCrespy@aol.com
Subject: [R-390] Capacitors.. leakage, replacing.... (and 24/7)

Thought I'd share some of my experience, adding a little fuel to the fires..

1. All three of my R-390A's are running original caps in most locations. Like Dallas, I have had more trouble with postage stamp caps than papers, and preemptively replace only the filter blocking cap and the 8uF cap on the AF deck.

2. My 51J-4 and R-388 are still running most of the original "oil filled (?)" bypass caps. Ever measured the leakage on one of these? Brand new ones check directly on the megohms scale with a VTVM ! Take a look under your SP-600, too!

3. One of my 390's (a Motorola) runs a few hours every day (not 24/7). No 3TF7 or 26Z5 failures in 3 years. All paper caps still in use on that one. It 'out-hears' my TS-850!

4. On replacing caps. I also prefer not to try to desolder the original joint. Too easy to heat damage other parts connected there. I prefer to splice to the old leads by twisting together, soldering, trimming and folding neatly back. As others have pointed out, Sprague actually sold splices that looked like tiny coil springs for this purpose .

Date: Wed, 03 Jan 2001 07:08:49 -0600
From: "J. G. Kincade" <w5kp@swbell.net>
Subject: Re: [R-390] Capacitors..replacing....

I'm with you, Harry. I also learned the replacement drill the hard way, by breaking off some tube socket pins, etc. trying to be "original", which is a bit of a joke when you are using bright orange radial caps as replacements for black and brown axials. :-) Now I use a very small pair of needle nose pliers and nippers, leave about 1/8 inch of lead or less on each end, put a

tiny hook in each end of the orange drop lead, and lightly crimp the hooks prior to soldering. Have never had a joint failure doing this, and have stopped causing more damage than I was fixing. The key is very careful length estimating and pre-shaping of the orange drop leads. After a little practice, it's easy and quick and it works great. Actually the biggest pain is straightening out the 90 degree bends in the original orange drop leads to make them fit like axial caps, without breaking up the coating where the leads exit the cap. I've gotten pretty good at it after a while, but messed up a few at first. However you do it, the less twisting, pulling, jerking, and heating you do on the original components, pins, and solder tabs the better off you are.

Date: Wed, 3 Jan 2001 08:27:12 EST
From: G4GJL@aol.com
Subject: Re: [R-390] On Replacing Capacitors

On the point of ugly and often over-sized Orange Drops, I would like to introduce the group to the Vishay-Roederstein range MKT1813. See them at rswww.com. search forRS stock No 185-4280 as an example.... These are AXIAL Polyester in 400 and 630 volt ranges (actually there are also 63 and 250 v ones,)..... Values range from 1000pF to 2.2uF, and include 0.033, 0.01, 0.22 and 0.1 uF. Advantages: They are very similar in appearance to the yellow Westcap tubulars in the Capehart and EAC decks I have seen. They have the leakage characteristics of Orange Drops (c. 30,000 M ohm - -55deg to +100 deg C) They are similar size or smaller than their 1950/60s equivalents. They cost me c.0.30 British Pounds each, from RS components or Farnell Components. Probably available in the USA too. Disadvantages: They are NOT orange! They dont have a natty name!

Date: Wed, 3 Jan 2001 08:51:51 EST
From: G4GJL@aol.com
Subject: Re: [R-390] More Capacitor Leakage

Barry, did you look for shorted wires around the NL pot? If you are running the 390-A with covers off, this is a place which is vulnerable to mechanical damage from other units above the rig in the same rack....or from fingers gripping the front panel in te wrong place.Try the cap (0.22uF) that is located on the pot itself, as it carries the audio signal when the NL is OFF.

Date: Wed, 03 Jan 2001 12:59:53 -0500
From: Jim Miller <jmille77@bellsouth.net>
Subject: Re: [R-390] Capacitors.. leakage, replacing.... (and 24/7)

My $.02 worth. I'm restoring a SW R390A which had all original caps. It

had a very low S-meter and AGC reading UNTIL I recapped the IF module (replaced all the molded caps with anything else I could find). She's now hot, purring with full (in spec) AGC voltage and healthy carrier meter deflection. That's all the proof I need!. Next will come all the other modules, whether they need it or not. Just do it!

Date: Wed, 03 Jan 2001 13:00:58 -0500
From: Jim Miller <jmille77@bellsouth.net>
Subject: Re: [R-390] Capacitors.. leakage, replacing.... (and 24/7)

One additional thing- I found some badly out of tolerance resistors I replaced also. It all helps.

Date: Wed, 3 Jan 2001 18:53:06 -0000
From: "Rob Filby" <robfilby@totalise.co.uk>
Subject: Re: [R-390] On Capacitor Replacement

I have been reading with interest the debate on whether to replace caps or not. In my experience of refurbishing and servicing 82 Racal RA17 and 117 rxs, I always replace the paper .1, .05 and .01uf caps. Considering the average age of these caps is over 36 yrs old I don't even bother testing them. Out comes the snippers and the little beasties are removed and nice 400 or 630v modern day caps installed (Axial Polyester film). In nearly 6 yrs I have not had one failure from using these caps and I have used over 4000 of them! The same goes for the carbon resistors which are typically used in the HT and screen feeds, they are replaced with metal film resistors of the correct voltage rating. I have had numerous resistors which are either O.C over 40meg or just crumble at the first touch. At the end of the day I would rather spend 30 hours replacing all the caps rather than checking each one.

Date: Wed, 3 Jan 2001 14:16:35 -0500
From: rbussier@lexmark.com
Subject: Re: [R-390] Capacitors.. leakage, replacing.... (and 24/7)

Not to beat the proverbial dead horse.....but I gotta add this..... The 'spare' 390A IF deck I have been using as an example of leaky caps, was also a SW out of an R-1981. It had a couple of the Vitimin Qs, but most of the caps were the brown tur* *. Dallas said his EAC had other, more modern caps in it . Every single .1 and .033 cap leaked, some dramatically. It is so easy to do, it's very worthwhile to test them and by golly, it's fun. Some replace them all, some won't touch 'em, I take the middle ground, 'cause that's what works for me.

Date: Wed, 3 Jan 2001 21:47:34 -0500
From: "Ed Tanton" <n4xy@att.net>

Subject: RE: [R-390] Capacitor replacement-several soldering points/pitfalls

There are several problems associated with both solder-suckers and solder-wick. First, ANY technique requiring the reheating carries a certain amount of risk associated with it, and should be minimized as much as possible. Next...

1. The problem with solder-suckers is the "splash" of solder they often fling. You just never can tell where it's going to go. I NEVER use one unless it's: a) antistatic (presuming there's anything solid involved); and b) on a pc board (ONLY) where I can clearly see there are no nooks and crannies for the splash to fly into. Furthermore, with the much larger amounts of solder typically associated with tube/lug technology, you need to apply multiple "sucks" (very appropriate word) to get just the bulk of the solder-increasing the amount of solder flakes flung around the chassis, and the net amount of heat yet applied to the original solder joint.

2. There are two minor problems you should keep in mind if using solder-braid: a) solder braid is essentially a metal (apparently copper) braid and a VERY active flux. I have never had a problem I could resolve to residual flux-after-braid-use... but then I always use a very active flux remover in such instances (acetone, followed by low-water-content alcohol using multiple long wooded Q-tips;) and b) solder braid is VERY HARSH on plated solder tips. Not so much chemically, as with the tendency one has to physically push the tip into/across the braid. So... if you want to use your plated-tip again, do NOT abraid it with solder-wick. I HAVE used it many times, and eventually wore enough of the plating off a WTCPT (or whatever the letters) 700 deg broad tip, that it just about won't melt solder anywhere on its surface, despite its obviously being hot as all getout.

The suggested 'cut out the part leaving a short lead, curl, install the new part' technique(s) are the best I have found. I've destroyed enough sockets, PC boards, etc. etc. over the years to know. Incidentally, several years ago, I was fortunate enough to find a freshly factory-rebuilt Edsyn Hot Air Soldering Station, with vacuum pick up, hot air de-soldering, and a regular iron. If you ever have the chance to get one surplus/used/etc. you ought to see the parts drop off a board, come up, etc. using hot air. It's very concentrated, and only heats the point you want to heat (size depends on the tip-I use ~1/8 inch for PC boards.)

Date: Fri, 5 Jan 2001 11:33:02 +1000
From: "Chris Gill" <micro@iig.com.au>
Subject: [R-390] Capacitor Replacement.

Just thought I would add my .02 worth re the capacitor debate, I appreciate that their are those on this and other list's who like to keep their radio's etc as near to original as possible, I too go through the replacing of the internals of chassis mount or plug-in Electro's but I have found that my collection of radio's and test gear produced from the late 30's thro to the 70's needed to have the various style's of paper/molded/wax caps replaced due to excessive leakage. Nothing has changed much, I still replace all caps in equipment I collect and use and as Dr. Jerry points out, by time you go to the trouble of testing each cap you may as well replace them all. Last year I got a HP 606A and followed Nolan Lee's advice in replacing the "Black Beauties" in the mains filter, plus some other caps, result I now have a very stable 606A. Following that principal I am replacing "all" caps in my 390A and a 391 however Orange Drops are a little hard to come by here in my part of Oz so I use a variety of cap's from the UK companies Farnell and Radio Spares who have a distribution network down here. Just my thought's, Chris Gill. Cairns, Australia.

Date: Sun, 14 Jan 2001 18:16:56 -0500
From: Glenn Little <glittle@awod.com>
Subject: Re: [R-390] New member, new R30A

>Acid leaking from the wet tantalum will EAT its surroundings. 73, Jerry, KOCQ

I will have to totally agree with this. We had a quarterly inspection to perform on a computer system that I worked on in the military. This was to look for the acid leaking from the Tantalum capacitors. This was just before CL65 type capacitors were disapproved for military use. The acid is concentrated Sulfuric. The case of the capacitor should be very close to pure silver. The acid is the electrolyte betweem the solid tantalum slug and the case. In time the seals break down and the sulfuric acid does its thing to everything surrounding it. A big mess and almost impossible to clean up to keep further corrosion from occuring.

Date: Sun, 14 Jan 2001 17:48:38 -0600
From: Nolan Lee <nlee@gs.verio.net>
Subject: [R-390] tantalums

Yep. But as a whole, they're pretty reliable compared to conventional electrolytic capacitors. Does anyone have any ideas why none of the parts catalogs seem to list any tantalum capacitors with voltage ratings above about 50 to 63 volts?

Date: Sun, 14 Jan 2001 21:28:03 -0600
From: "Dr. Gerald N. Johnson, electrical engineer" <geraldj@ames.net>

Subject: Re: [R-390] tantalums

According to a book I have here on capacitors, Tantalum voltage ratings don't exceed 60 to 90 volts, so higher voltage capacitors in its day used several cells in series (and the wet tantalum used concentrated sulfuric acid as electrolyte). Any spills probably need to be cleaned up with a baking soda solution, just like cleaning up spills from a car battery.

Date: Mon, 15 Jan 2001 00:12:17 -0500
From: "Barry Hauser" <barry@hausernet.com>
Subject: Re: [R-390] tantalums

Speaking of wet tantalums, three out of three in R-390A's I've looked at so far have completely leaked out. Damage thus far has been limited to a darkened/eaten spot a little smaller than a dime on the circuit board and cosmetic damage to a neigboring cap. Fortunately, these things are small, and from what I can determine, some/many? start to leach the acid slowly for
a while so it just self-destructs, or leak slowly enough that the acid doesn't go too far. While on the subject, I recently came by an APR-4Y receiver with 38-1000 MC converter plugin that was modifed for 60 cycle AC, among possibly other things, e.g. tube rectifiers solid stated out. (These were originally built for aircraft AC -- 115V 400 cycle. I haven't traced all the mods, but there's a small perfboard in there with 3 small transistors, a couple of resistors and three of those wet tantalums. The silver is discolored, mostly blackened with tarnish and "threatening". I can't quite make out the values on them and will probably have to remove the board and unsolder one end of each to read them. (BTW, nice touch to install components so markings show guys). Not sure I'll be able to read them anyway. Was there a wide range of values on these, or did they tend to run in a handful of values? I suspect small electrolytics would have filled the bill, but the modder had these on hand, they were bright and shiney, cool looking and ... Any suggestions? Maybe I should make a little baking soda "containment" for them just in case.

Date: Mon, 15 Jan 2001 01:23:09 -0500
From: "Mike B. Feher" <n4fs@monmouth.com>
Subject: Re: [R-390] tantalums

The early slug tantalums were notorious for leakage. You can easily locate them because at a minimum, by now, one lead is probably green. 73 - Mike

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Date: Mon, 15 Jan 2001 06:53:59 -0500 (EST)
From: "Paul H. Anderson" <pha@pdq.com>
Subject: Re: [R-390] tantalums

<http://www.pdq.com/pha/r390/r390-furry.jpg> is a good picture of C-609 in
the audio deck.

Date: Mon, 15 Jan 2001 10:29:00 -0600
From: "Dr. Gerald N. Johnson, electrical engineer" <geraldj@ames.net>
Subject: Re: [R-390] tantalums

A wide range of wet tantalum values was available.

Date: Mon, 15 Jan 2001 20:55:07 -0500
From: Roy Morgan <roy.morgan@nist.gov>
Subject: Re: [R-390] tantalums

Why worry?? The tanalum capacitor in the R-390 works at just a few volts.

Date: Sat, 24 Oct 1998 09:18:48 -0500
From: "Dr. Gerald N. Johnson, P.E." <geraldj@ames.net>
Subject: Re: [R-390] Caps and the VTVM.

0.005 was never a RETMA standard value, just something left over from pre standard days. .0047 is 6% away, the .005 disc or paper capacitor was probably at least 10% tolerance which makes .0047 and .005 interchangable in all but resonating capacitors. .01 is 100% away though if disc ceramic GMV not 10% tolerance its value at tube radio operating temperature may only be .06.

The meter loads the circuit. The books were made with a VTVM having a fixed input R, probably 11 megohms. Using a different type of meter impedance should often give a different reading. E402 sounds like an AGC voltage, and there the impedance is highest.

To compare the DMM reading to the VTVM reading you have to know the resistance of each, and then the impedance of the circuit to compute the different effects of loading. Simple engineering level circuit analysis. But that much difference -.15 instead of -4.8 makes it look like there's a circuit problem. Still some black beauties in the circuit?

Date: Mon, 26 Oct 1998 09:32:23 +0530
From: "Percy Mistry" <Percy_Mistry@ril.com>
Subject: [R-390] How 'bout this cap leakage test..?

I thought about this simple (or shall we call it elementary) way of checking a cap for leakage. I connect the cap in question in series with a 1 Meg resistor and apply a DC voltage (equal to or greater than the working

voltage of the cap) to the ends of this partnership. And then I measure the voltage across the 1Meg resistor. If there is a leakage of even 1 microamp, there will be 1 full volt across the resistor. Normally, I found about 90 to 120 millivolt for good and new caps. Talking of new caps , I got 10 new .0047 and had to reject 3 (!!) because they leaked more (4 times more) than the others. I don't know whether this was a one time coincidence or it may happen everytime.....but I'll never replace any new caps before they pass 'my' test.

Date: Mon, 26 Oct 1998 07:41:24 -0400
From: laffitte@prtc.net (laffitte)
Subject: [R-390] Stewart Warner Report

I just recapped the IF subunit of my Stewart Warner R390A. All the brown beauties were replaced and all were found to be leaking badly after testing them with a Sprague TO4 Cap Tester (thanks Jim!). I also had replaced a couple of West caps from the audio section. The older ones tested very good so it seems that the West caps hold better than the Brown Beauties. So when you see the Brownies just replace. Don't even think twice about it. The results of the replacement were good. The signal level is higher but still not equal to my EAC. The next step is removal of the RF subchassis. I will report on this soon.

Date: Tue, 27 Oct 1998 11:09:08 -0600
From: "Dr. Gerald N. Johnson, P.E." <geraldj@ames.net>
Subject: Re: [R-390] C408 / C409 value and rating

22 meg is high enough. I'd forget the 1 meg in the capacitor test set up and set 2 volts as the leakage limit with the DMM in series with the capacitor.

Date: Tue, 27 Oct 1998 20:07:12 -1000
From: petesr@juno.com (peter, sr. a. wokoun)
Subject: [R-390] Black Beauties and Orange Drops

Came across the following descriptions from a Sprague Ad in the '66 ARRL handbook:

Black Beauty Caps: dual dielectric (polyester film and paper) combines best features of both. Solid impregnant, nothing to leak or drip. Molded case. Withstand high temperatures, high humidity.

Orange Drop Caps: dual dielectric (polyester film and paper), with solid impregnant. Double dipped in epoxy resin. Radial leads, ideal for printed wiring boards.

'cept for the impregnant, solid vs double epoxy dip, seems like these are

the same caps! And we're replacing one for the other???? Not me; there are better ones available today....

Date: Wed, 28 Oct 1998 00:32:37 -0600
From: "Dr. Gerald N. Johnson, P.E." <geraldj@ames.net>
Subject: Re: [R-390] Black Beauties and Orange Drops

Funny how that solid impregnant drips out a cracked case like oil. I think earlier black beauties were purely paper and mineral oil and later Orange Drops are pure polyester, no paper. I've never detected any oil, but when you roll up an insulator and foil you have to fill the minute gaps with something or each creates an air arc to destroy the insulation. E.g. with a mil of solid insulator and 0.1 mil of air, the diectric constant of the air is enough lower that you get most of the voltage across the air part of the gap and that's enough to break down that thin air film and so you have a glowing arc. The heat from that damages the insulation. That's why there's oil in oiled paper capacitors and why sputtered aluminum film capacitors work better with less insulation thickness than foil/insulator wind ups.

Date: Wed, 28 Oct 1998 16:18:23 -1000
From: petesr@juno.com (peter, sr. a. wokoun)
Subject: [R-390] Orange Drops

I did a bunch of web searching after my last post on the questionability of using Orange Drops.... Sprague originally had the 'orange drop' line. It apparently only referred to the orange-colored epoxy conformal coating put over 'something' with radial leads. That something could be anything from a paper to a whatever type capacitor. I previously had thought the name 'orange drop' referred to some better-quality type cap -- no, just to the coating with radial leads! I was unsuccessful in finding some old sprague catalogs that showed just what came under that orange covering. Somebody have any? In 1986 SB Electronics bought the 'orange drop' name and now produces what is referred to as the 'Orange Drops'. They produce them in polypropylene and polyester dielectrics. Go see their web site if you want to know more than you know now: www.sbelectronics.com. So, If anyone is using NOS sprague's, the question is: do you know what you really got? You could have a black beauty in a orange case. (hey, it's almost halloween). The new ones made by SB Electronics are pretty good if their spec sheets are true. So my last word today is: dump the Spragues and use the SBEs.

Date: Wed, 28 Oct 1998 21:32:56 -0600
From: "Dr. Gerald N. Johnson, P.E." <geraldj@ames.net>
Subject: [R-390] Re: Orange Drops

I guess I'll have to dig out the Sprague catalogs of 1957. Then I believe that black beauties were purely oiled paper, no polyester. When Orange Drops came a long they may have been polyester and paper, but their leakage was so much better and my samples have REMAINED in super shape that I have 40 years of confidence. I don't in others. The polyester/paper black beauties came later because the original black beauties (and other similar Aerovox and other brands) of oiled paper were really so bad. And I'm certain the original black beauties had NO polyester, just kraft paper (brown butcher paper) and mineral oil. All the Sprague Orange Drops were dipped, never molded. I have either Sprague catalogs of the era or Electronic Master's or both up in the attic. SB electronics bought most of Sprague. Sprague factories and equipment and employees. Sprague taught SBE everything they know. CDE's equivalent to the orange drop was a molded pale green. Some varieties probably were as good, but they've remained harder to purchase over the decades. Right now I don't have room at the computers for that catalog collection to dig through, especially with one computer all apart.

The latest Mouser catalog says Vishay-Sprague...

Date: Thu, 29 Oct 1998 11:03:41 +0530
From: "Percy Mistry" <Percy_Mistry@ril.com>
Subject: [R-390] In favour of Recaping.

After recaping all .1, .01, .033 and .005 caps in my EAC R-390A/URR, I vote for recapping. At the same time I confess that I didnt find a cap which was leaky enough to bring down the performance of the whole receiver all by itself. My conclusion on this subject is that :- A fractional (maybe ignorable) leakage in almost all caps in the receiver add-up together to obstruct the overall gain/performance . Each one contributes fractionally in its own area (circuit area) to make a sum for the whole area. That is why, I think, you get confused when there are two mutually exclusive 'facts' before you. One is that the caps you removed arnt 'that' leaky and second is that when you have replaced all of them, there is a typical sparkle in the performance..... like it has become young again.....more energetic.....like it was. And afterall, 40 years is indeed a long time.....for a cap. GO !! Change them.....GO !

Date: Tue, 16 Jan 2001 18:05:34 -0500
From: Gene Beckwith <jtone@sssnet.com>
Subject: Re: [R-390] different thread / question

Make it standard exercise to replace all the old caps...just do it and don't take chances... I mounted fresh electrolytics under the chassis... there's plenty of room... I did one last year and found a bad molded cap in the oscillator can that prevented the unit from changing sidebands. took a

while to track it down but found it... the unit works great and worth the effort to bring it back to life...

Date: Mon, 22 Jan 2001 11:15:45 -0800
From: "Roger L Ruszkowski" <rlruszkowski@west.raytheon.com>
Subject: [R-390] Rebuilt Capacitors

For those of you who need filter caps in those almost exact cans, (now a bit shorter after rebuild) delete this message and go on. I was able to get 2 45-UFD and 3 30-UFD caps into the 8 pin octal socket relay case. I used 350-Volt axil caps. The relays are the clear plastic DPDT relays.

I had a problem with my 1-UFD AGC cap on the IF deck. I put an 8 pin socket in the mounting hole for the original can. I then installed a 1-UFD cap into a relay case and plugged that in. There is also the .01 AGC cap under the 1 UFD cap. I grounded one of the socket pins and also installed the .01 AGC cap in the relay case. I put the socket on top of the IF deck. I was not willing to move all the wire under the deck necessary to get the socket installed from the
bottom of the IF deck.

Date: Tue, 30 Jan 2001 10:29:03 -0600
From: "Dr. Gerald N. Johnson, electrical engineer" <geraldj@ames.net>
Subject: Re: [R-390] Caps,

I think the black beauty color code is two bands value, one band multiplier (in pf) and one band hundreds of volts. So a .01 400 volts would be brown black orange yellow.

Capacitor color codes have never been as consistent as books listing them. A bridge has been necessary to see which color code applied. <snip>

Date: Fri, 9 Feb 2001 22:05:42 -0800
From: keith <khgrant@ix.netcom.com>
Subject: Re: [R-390] Bandwidth Problem?

You mean C103? I do have a replacement at hand but havn't installed it yet. Unfortunately, its a tiny modern one, not the big bathtub type. I havn't figured out a good place to mount it. How did you change that cap? Did you replace the whole unit or did you open it up somehow? Can it be opened up? I'd like to learn the technique!

On Tue, 06 Feb 2001, G4GJL@aol.com wrote:
> Could this hissy noise be something to do with the electrolytic cap at the
> bottom of the RF gain control (electrically)..... Physically, the cap is
> located in a bathtub near the mains line filter, on the rear apron.

> Has anyone had experience changing the cap in that bath tub?
> I have done it on one of my sets, but there was no noticeable change in
> performance or perception. The old one measured 10 ohm forward or reverse on the AVO.

Date: Sat, 10 Feb 2001 04:36:22 EST
From: G4GJL@aol.com
Subject: [R-390] Bathtub capacitor replacement

Hi Keith.....Thanks for your prompt for C103....Yes that is the one..... This is my procedure. I wrote this for some guys doing AR88D cap replacements. Those caps leak like hell, but as the C103 in R390-A is of the same CONSTRUCTION, the procedure applies here. My C103s did not leak oil, just went electrically leaky, and off value. Note, though that C103 is electrolytic, whereas other older bathtubs in 40s and 50s rigs are mainly oil / paper, hence the references to oil and safe disposal of same.

Here goes:

1. Note colour and purpose of wires. Pay attention where more than one wire terminates on the tag. Draw diagram of wire routes, cap locations and their values, to avoid confusion when re-assembling.

2. Unsolder wire from tag (125 Watt Gun). Or snip through tag to avoid solder splashes etc.

3. Unscrew two mounting screws, and retain for reuse. Place cap on plastic tray lined with newspaper

4. Wear Rubber Gloves. Clean and de-grease the cap can. I used kerosene (paraffin) in a glass jar and a small rag.

5. For the paper / oil types you need to do this: With cap held in vice fitted with soft-jaws, hacksaw through the fibre washers and rivets forming the feed-thrus in the cap case. More oil
will leak out. Mop with kerosene and rag. Avoid contamination of tools, workspace and most of all YOURSELF!. For electrolytics, I have found that generally you can skip sawing off and replacement of the feedthrus, therefore go to step 6

6. Work outdoors.
Wear eyeshields and rubber gloves, use a butane flame torch to melt solder holding closure plate at the rear of the bathtub. Hold in vice or get a second person to hold cap while you use the torch. Watch out for solder splashes, escaping bubbling oil and oil fumes. When the solder is melted, use a small screwdriver (or similar) to pry off the back plate. Normally

they are a loose fit, once the solder is melted all the way around. Place on paper in plastic tray to cool.

7. Remove the capacitor innards, and place on newspaper in plastic tray. Drop waste oil into a sealable container. Swab out the cap can with new kerosene and new rag. Place cap can on clean dry paper to dry. Place gloves, tray and all contaminated waste and sealed oil container in a plastic bag marked PCB OIL FOR DISPOSAL. Dispose of properly at your local refuse / garbage tip.

8. .....Only if you want to replace the feedthrus too.....else go to step9. I obtained some ceramic feedthrus some years ago. These were used by a transformer manufacturer to connect wires through the case of an oil filled transformer....perfect!! You can get similar from scrapped VHF RF gear. Voltage rating 1kV or similar. Solder three feedthrus to each cap can in the original holes. (I used a 125 Watt Weller gun for this)

9. Solder new caps to the inside of the feedthrus, and solder their ground leads to any convenient point inside the cap can. (Outer foil rules apply) Use voltage over-rated capacitors, of the same value as marked on the bathtubs can - modern caps of the same voltage and capacity tend to be physically smaller than their 50s / 60s counterparts, so they fit inside easily..

10.I did not re-solder the back plate, just push it in to the cap can and reverse process or fixing and re-soldering the external leads as per notes taken in steps 1&2 above.

Hope this is use to you, and others on the list. A question remains, though..... Has anyone actually noticed any differences in performance of the R390-A after changing a bad C103?

Date: Sat, 10 Feb 2001 08:40:27 -0800
From: keith <khgrant@ix.netcom.com>
Subject: Re: [R-390] Bathtub capacitor replacement

Good description. Sounds kind of messy! How do you measure leakage on this cap?

Date: Sun, 11 Feb 2001 05:57:23 EST
From: G4GJL@aol.com
Subject: Re: [R-390] Bathtub capacitor replacement

I used to use the leakage position on my transformer ratio - arm bridge. But that only tests at 10 v or so. I have adopted Dr Jerrys method of using a varivolt bench PSU and a 100Mohm input impedance VTVM . As a series circuit, it is described below:

Output of PSU goes to first wire of C under test.
Other end of C goes to VTVM input HIGH
VTVM LOW strapped to ground
Ground returned to PSU negative
PSU negative strapped to Ground

Your acceptance of what is or is not leakage will vary, but with Polyester tubulars that I use I can only 'see' the residual noise when the cap has stored its charge.....this is at about 10 to 15mV for 0.01 uF 400v rated Vishay Roederstein Poly tubulars at 1.5 times the rated voltage applied.

Almost all BA caps are so leaky you cannot get down to these levels...you will see to PSU voltage build up across the "C' before you get any where near to the cap retaining a charge.

Date: Fri, 16 Mar 2001 06:31:02 -0600
From: "J. G. Kincade" <w5kp@swbell.net>
Subject: Re: [R-390] Source for Capacitors?

Amen! Last of the big outfits willing to be nice to the little guys. The Radio Shack Commercial Catalog is pretty good, too. They sell a "blue drop" similar to the Orange Drops, about half the OD price, made in Taiwan. Used quite a few, they have worked perfectly. BD's are flat and rectangular, and are a little smaller, and therefore easier to install, than equivalent OD's. They also don't have the stupid double crimped PC board leads, which are a small but constant OD irritant. I'm starting to choke on the price of OD's anyway, especially in the larger sizes. Maybe the audiophools have gotten to them.

Date: Fri, 16 Mar 2001 04:57:50 -0800 (PST)
From: Bob <enigma_y_2000@yahoo.com>
Subject: Re: [R-390] Source for Capacitors?

I buy from Frontier Capacitor. Everett Hoard is the owner, and a classic kind of guy. Ph 1-701-378-2341. Email frntcap@bektel.com Fax 1-701-378-2551
Good guy to do business with. Also rebuilds can capacitors.

Date: Fri, 16 Mar 2001 11:43:23 -0500
From: "Jim Miller" <jmiller@iu.net>
Subject: Re: [R-390] Source for Capacitors?

I agree, Mouser is the best, bar none. They even call to follow up if there is a problem. I have never had a problem with them, and the prices are very very reasonable. Not the 10x inflated prices that joke Newark charges.

Date: Thu, 24 May 2001 18:40:58 -0400
From: Bob Camp <bob@cq.nu>
Subject: [R-390] R-390 Capacitor Data

Had to put R-390 in the title or you might think this was off topic :) My fancy new TO-5 (to me) boat anchor capacitor tester arrived today and with it came a manual (dated 1958). According to the Sprague Company here's the data on capacitor leakage:

Paper Capacitors - when new and value <= 0.1 micro farad

Wax coated - > 5,000 M ohms (yes 5 giga ohms)
Vitamin Q - > 30,000 M ohms

Electrolytic Capacitors 300 V after 5 minutes on power

33 microfarad < 1.2 ma leakage
45 microfarad < 1.4 ma leakage

Mica caps

molded case > 3,000 M ohms
silver mica / low loss case > 6,000 M ohms

Ceramic Capacitors

below 0.02 microfarad > 7,500 M ohms

All data given is for new parts. Nothing is mentioned about what should be expected of used parts other than that "electrolytics with leakage > 15 ma should always be discarded". I suspect they wrote the manual to sell replacement caps :)

I guess that the data above pretty much confirms what has been said before. If you can detect any insulation resistance on the mica, ceramic, or paper caps with anything short of a bridge or an HP-412 then they are bad.

Date: Mon, 4 Jun 2001 10:13:22 -0700
From: "Roger L Ruszkowski" <rlruszkowski@west.raytheon.com>
Subject: Re: [R-390] R-390 Capacitor Data

I have no clue as to how much the old brown and black beauties did or did not leak. We do need to remember that back when they were tight enough to operate a hell of a lot better than they tend to do these days. I was not a

great believer in the recap story. Now that I have gotten them all weeded out, I say, Just do it.

Those things must have been leaking back in 1970, because my receiver works better now than the ones I was working on back then. (I have put more effort into this one in the last 15 years than I ever did the ones back then also) so it could be comparing red and green apples with the yellow apples.

Date: Mon, 04 Jun 2001 18:20:35 -0400
From: Bob Camp <bob@cq.nu>
Subject: Re: [R-390] R-390 Capacitor Data

I have no doubt that the paper caps started leaking almost as soon as they went into service. One theory for the leakage is humidity, the other is supply line spikes. Either way they started to go bad quite a while ago.

Date: Mon, 4 Jun 2001 21:44:26 -0700 (PDT)
From: Joe Foley <redmenaced@yahoo.com>
Subject: [R-390] Black Beauty Capacitors

I snagged a 1966 catalog from Standard Electronics from the Rochester Hamfest for $2.

The Sprague listing for BB Capacitors shows that Black Beauty is a registered trademark for their capacitors with the RED lettering on a black case. Someone in the past mentioned that the ones with the YELLOW lettering were the bad ones and the RED ones weren't so bad.

Anyway, the sales dribble in the caption under the picture says: "Developed especially forlong life under high humidity and temperature operating conditions."

"Dual dielectric (film and paper) combines the best features of Polyester Film and paper capacitors." "Exclusive HCX solid impregnant construction results in rock-hard capacitor section."

"Won't leak or drip." "No derating for 105 degree operation." "Mica-filled, non-flammable, molded case, won't crack when dropped, soldering won't harm it." And a bunch of other garbage.

Then in big, bold letters: THE WORLD'S BEST MOLDED TUBULAR AT NO EXTRA COST! So there you have it folks! You got the best they could offer?

I also picked up a copy of TM 11-668 for $2 which is a workbook for FM

transmitters and receivers dated 1952, its full of schematics but no indication of which radio equipment they're showing.

Date: Tue, 5 Jun 2001 09:29:40 -0700 (PDT)
From: Joe Foley <redmenaced@yahoo.com>
Subject: Re: [R-390] Black Beauty Capacitors

Well, I've seen them with yellow lettering on a black body and the ones I mentioned that have the red lettering on a black body. Evidently, the ones with the red lettering are the only ones that were actually called Black Beauties as Sprague shows it to be their registered trademark. But that's just what I saw.

Date: Tue, 5 Jun 2001 18:04:54 -0500
From: "Larry Saletzki" <wa9vrh@ocslink.com>
Subject: Re: [R-390] Black Beauty Capacitors

Hi Norm I have some never before used with red and also some with yellow and they all check bad. Best thing to do is get them all out! I recapped a Collins 75A-4 a few years ago. I was very careful and would replace 2-3 then try the receiver again. I got to a group where it was impossible to do any less than 7 of the little buggers. I made drawings I took notes. I finally got them all in and layered like before. It was about a 3 hour process. I powered up the 75A-4 and it had the most awful static and scratching noise coming from it. It thought for sure I killed it. I shut it down and retraced everything... Nothing looked wrong but it sounded like hell. I powered it up again and the same thing. Bewildered as to what I had done to my 75A-4 I was not sure what to do next. (by the way this was far from the first such project) I glanced up to the fluorescent lights above my workbench and walked over to the switch. I turned the lights off and the 75A-4 went to background noise... Since then if there is a black beauty: out it goes. I have checked a number of them that I have replaced and well over 80% are bad with no visible sign on the outside. Hope this helps!

Date: Tue, 17 Jul 2001 12:49:26 -0400
From: "Paul Bigelow" <pbigelow@us.ibm.com>
Subject: [R-390] Non-polarized electrolytics

As I understand it non-polarized electrolytic capacitors are like two polarized elecrolytics in series with the ground tied between them.

With radial, non-polarized electrolytics should it be possible to measure a DC voltage between the outer aluminum case and ground? If there is any measurable DC would that indicate leakage? It the case connected to either lead? I would think not.

With axial electrolytics the case is usually negative.

With polarized electrolytics I understand that the case is sometimes not negative (just floating).

Date: Mon, 03 Sep 2001 19:27:49 -0400
From: Glenn Little <glittle@awod.com>
Subject: [R-390] Vitamin Q capacitors

Are the Sprague Vitamin Q capacitors as problematic as the Black Beauties? I have some Vitamin Q caps that I would like to use in rework of a R390A. These are paper caps that are oil impregnated with a metal case. Before I replace bad caps with more bad caps I raise the question. If these capsa are ok, I can use what I have, otherwise I will have to buy some Orange Drops.

Date: Mon, 3 Sep 2001 19:33:48 EDT
From: Llgpt@aol.com
Subject: Re: [R-390] Vitamin Q capacitors

No, they sure aren't. As a matter of fact the vitaminQ caps seldom if ever check out bad. Different construction must be the answer. Les Locklear

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Date: Mon, 03 Sep 2001 20:15:23 -0400
From: Barry Hauser <barry@hausernet.com>
Subject: Re: [R-390] Vitamin Q capacitors

I found one big NOS Vitamin Q in my parts bin -- neatly split the long way and sprung open with its innards showing. These were probably great until the extended warranty ran out at the 30 year point. Not a good choice any more.

Date: Sat, 8 Sep 2001 13:45:18 EDT
From: DAVEINBHAM@aol.com
Subject: [R-390] ReCap kits for SP-600 & R-390nonA coming soon

Since my post last month I have received orders for 2 more ReCap kits. That is enough to make it worth while to keep on doing the kit for a while. Also, work is progressing on the kit for the SP-600 recap kit. It will be available in the next 10 days or so. Many of you have requested a recap kit for the R-390 nonA. I never got around to it, but that has now changed. My own nonA died last week. I opened it up and found a couple of the Vitamin Q's had puked. Soooo, a nonA kit is on the way very soon. It will, unfortunately, be more expensive because there are a helluva lot more capacitors in the R-390nonA than the R-390A.

Also, in spite of what it says below, I am temporarily out of the in-the-can electrolytics. Sold all of them I had to a brave soul who does not mind dealing with the dreaded black ukkumpucky. I will get more in-the-can types when I get the caps for the SP-600 & nonA kits in a few days. So, if you order a kit with in-the-can capacitors, there will be a wait of about 10 days or so before I can ship it.

In response to my post last week inquiring as to how many of you would be interested in brand new, not rebuilt, plug in electrolytics for the R-390A, I got 4 respondents who would buy 13 sets of them. I guess that is probably the end of that.

R390A capacitor kit. I have put together a ReCap kit for the R390A. It consists of:

(13) 0.1 ufd
C256, C309, C504, C505, C517, C521, C528, C531, C536, C538, C543, C547, C548

(7) 0,033 ufd
C275, C529, C533, C534, C541, C545, C602

(7) 0.01 ufd
C549, C553, C601, C604, C605, C607, C608

(The above are Orange Drops or equivelent.)

(3) 30 ufd 300 v electrolytic C603A, C603B, C603C
(2) 47 ufd 300 v electrolytic C606A, C606B

(The above electrolytics have axial leads. You can wire them under the chassis and leave the originals in place to retain stock apperance. Or you can order capacitors small enough to fit inside the cans of C603 & C606. Just remember you will have to deal with the Dreaded Black Ukkumpucky to get the guts out of the cans of C603 & C606. If you do not specify at time of your
order, the under the chassis capacitors will be shipped.)

Finally, one each of :

0.047 ufd 100v C227
8 ufd 30v tantalum electrolytic C609
50 ufd 50 v electrolytic C103
0.22 ufd 100 v C101

I cannot find a source for: 2 ufd 500v C551 oil filled paper so, I will include a very high quality poly cap. I have installed one of these in one of my R390A's and I can say I cannot hear any difference. They work great. This is the AGC capacitor.

The price for this recap kit is $80.00 US funds. Price includes UPS or US post delivery. Canada and mexico US$85. Western Europe, South America and Pacific rim US$90, rest of world US$93. All sent airmail if possible. ALABAMA RESIDENTS MUST ADD US$3 STATE SALES TAX.

Send orders to:
Dave Holder
Biological Instruments, Inc.
820 South 29 th. Street
Birmingham, Alabama 35205-1004
USA

Payment may be check or US currency. (If you send cash put it in an envelope inside the envelope you mail. AND IT IS ENTIRELY AT YOUR RISK) Sorry, no credit card orders.

Before anyone starts to bitch about the price, please bear in mind, my gross profit will be about $3.12 per order. That should earn me something less than minimum wage..... before corporate and personal taxes. I reserve the right to withdraw this offer if it gets to be a pain in the butt.

Date: Wed, 5 Dec 2001 16:26:34 -0800
From: "Roger L Ruszkowski" <rlruszkowski@west.raytheon.com>
Subject: Re: [R-390] About these caps.

Bill, You ask about these caps.

There are several different types in several locations. Depending on the state of your bank account you want to consider each cap in your radio in a different light. Right up front, If your looking to replace all those expensive mechanical filters in the IF deck for no other good reason than you can afford to, stop reading this mail. delete it and ignore the cap C-553 in the IF deck that keeps the B+ out of the filters. If you can not afford to buy new mechanical filters then
you should at least open your IF deck and see if the cap has been replaced in your receiver. What the hell an afternoon and a 50 cent part can save you a few hundred dollars, so its cheep to change. I suggest a look at the following site.

http://www.avslvb.com/R390A/html/C-553.htm

Next on the list is a little acid filled cap in the audio deck. It leaks acid all over the audio deck. You mite look in there and see how your personal unit is doing. Most people like to get that thing out of there and use a more modern cap with a non liquid center. There are a range of replacement preferences. Each had a its own fan club. Again your choice

Right there on the AF deck is a pair of plug in electronics. If you are using your receiver as a boat anchor you may not worry about them. Then again if you are actually listening to your receiver and still have a hearing capability down to say 120 or 60 hertz or so then you could want some better (newer) caps in those locations. After time those cap may not be leaking very much but the UF are also not up to snuff and the B+ ripple is above the level you could be enjoying for nothing more than a replacement part. The problem here is finding a new plug and play part. Most of what we find is New Old Stock (NOS) and those parts may be no better than what you have.

Options are.
1.) Do Noting
2.) Parts under the deck
3.) Refill the old cans
4.) Fill a relay cases with caps and use those.

These have all be done.

The do noting path is exciting. One day one of those old ones will literally blow up under there. What a mess what a noise what a smell It's so really cool and you get every last bit of use out of the parts.

Next is the AGC caps. some like to fool around with them to get better performance or at least different performance from the AGC. The big oil filled one on the IF deck almost never goes bad. Its the nature of oil filled ones to survive.

Then there are the beauties. there are 3 kinds of these. The original are all the original silver Vitamin Q type. The next ones were the real black beauties. The last ones were the brown beauties.

Some day the latter younger brown beauties will get as old as the black beauties and be just as legendary for their failures.

The Vitamin Q's hold up pretty good. You change them out because over time they have lost some of their capacity. the .01 has a value closer to .005 than .01. Its an age thing. In a whole lot of places you can not tell if the value has changed.

Should you own a receiver populated with the real black beauties you may want to replace them all if your inclined to actually utilize your receiver in that capacity. These are the ones that do crack open and fail.

The last bunch are the brown beauties. We do see them fail.

Over time caps just loose capacity. In circuits where the original cap was over sized to start with, it will be a long time before you can detect a change in the cap from just receiver performance. Some caps do effect performance in a hearable way (Power supply filter caps on the audio deck). A couple caps get replaced / refreshed because letting them die a natural death causes expensive problems else where (C-553 in the mechanical filter circuit and the electrolytic in the audio deck).

Leaky pesky caps in the AGC circuit are generating a lot of heartburn for current owner these days.

Where your receiver has been in its life makes a lot of difference in how your caps are doing today. If your receiver froze over a winter at Julian Creek or in a warehouse in its life, then your caps are not fair as well as say the one who enjoyed life in Texas. Then there is the consequence of the receiver having spent a year in Phu Bia Viet Nam with me. Being in Phu Bia was not a problem for your R390. But If I was its maintenance man dipping it in the Mill (Typewrite) degreaser machine once every six months, then your receiver could be suffering much chemical induced toxic shock to more parts than just its plastic caps.

I'm sorry, I was told those receivers were going to be replaced with new sand state Racal's any day soon. I did know I was being lied too. I did not know we would still want them 30 years later. Sorry Guys. I mean it. It was a mistake. I just bring it up so every one can do whatever is needed to preserve what is left as best we can.

Ok so you do not have to just jump in a recap your receiver from A to Z before you turn it on again. Some of those little one may never get changed But between nothing and every thing is a kind of middle of the road sane approach that feels sort of natural for real long term R390 owner operators. On any day some extreme voice will cry out and an equally extreme counter voice will cry out to ignore it. Some where in the middle is sanity. Along with sanity is a thing called cost avoidance. Some times you spend some money to save money. Some times you chose to spend no money.

The R390 is pretty complex. To cover it with a blanket one size fits all statement is just not going to get you rated a level headed by folks who have done a few winters in life.

Then again your mileage may vary.

Date: Thu, 6 Dec 2001 10:28:48 -0800
From: David Wise <David_Wise@phoenix.com>
Subject: RE: [R-390] About these caps.

Roger L Ruszkowski writes: [good stuff snipped]

> Right there on the AF deck is a pair of plug in electronics.

Electrolytics, that is. I've heard a whole spectrum here. Some are awful, some are fine. Measure their capacitance and leakage, at operating temperature and voltage. Mine are superb, but I think I was lucky.

> Next is the AGC caps. some like to fool around with them to
> get better performance or at least different performance from the
> AGC. The big oil filled one on the IF deck almost never
> goes bad. It's the nature of oil filled ones to survive.

The problem is, C551 is usually a soft degradation that can be tough to diagnose, in a circuit that's already mysterious to many. I replaced mine after checking it for leakage. Once again, check it hot; leakage varies dramatically with temperature. Mine read a perfectly acceptable 2uA cold but 100uA hot. 100uA into the 100s of K impedance AGC circuit is tens of volts, enough to drive the set to the edge. It will compensate, after all it's a pretty robust design, but it won't be happy. Here's an easy way to check it:

1. Remove the antenna, V506, and the AGC jumper on TB102.
2. Put a high-impedance DC voltmeter on TB102 pin 3.
3. Measure voltage in AGC FAST mode.
4. Set to SLOW, wait 10 seconds, and measure again.
5. Direct a hair dryer at C551 until it's hot but not painful, and measure again.

If steps 3, 4, and 5 are equal, congratulations, you have a great cap. IMHO odds are you'll find that 4 and especially 5 give a much more positive voltage, and that's bad. You won't find a plug-n-play replacement. I unsoldered the can, gutted it (messy!), and inserted a modern replacement. Under-chassis replacement is possible but there's little room. The replacement doesn't have to be 500V, 250 is fine.

> Then there are the beauties. there are 3 kinds of these.
> The original are all the original silver Vitamin Q type.

I'd be surprised if there were any all-VQ R-390As. That was one of the

changes in the R-390 / R-390A cost reduction. VQs are expensive!

> The next ones were the real black beauties.
> The last ones were the brown beauties.
> Some day the latter younger brown beauties will get as old as the black beauties and be just as legendary for their failures.

About half are cathode bypasses that never see enough voltage to stress them. The other half are plate bypasses; if they go they'll take at least a resistor with. I baked my IF deck wit h B+ (no tubes), and one did short. (I used a current-limited supply; no resistors were harmed in this demonstration :-)

> The Vitamin Q's hold up pretty good. You change them out
> because over time they have lost some of their capacity.
> the .01 has a value closer to .005 than .01. Its an age thing.
> In a whole lot of places you can not tell if the value has changed.

I respectfully disagree that they change; I think you're getting some crosstalk with electrolytics. I've never seen a VQ (or any paper cap) change value; they just leak, short, or (occasionally) open. Doesn't mean it's impossible, but I've tested hundreds of paper caps. OTOH a leaky cap is not a pure reactance, and this distorts the reading on a TelOhMike or similar bridge. I checked a few of my brown beauties at RF. They bypassed 10MHz about as well as any other cap in the junk box. During the bake, I checked my VQs for leakage too; all those I could test (i.e. not shunted by a resistor) were excellent. If you pull the IF deck you can get most of them with a power supply and lots of jumpers. [other good stuff snipped]

From: "Bill Smith" <billsmith@ispwest.com>
To: "Gregory W. Moore" <gwmoore@moorefelines.com>,
Subject: Re: [R-390] Capacitor replacement when restoring
Date: Wed, 9 Jan 2002 19:31:34 -0800

My understanding is it varies with manufacture of the unit. Others can give you better details. For example, my R-390 is filled with "Vitamin Q" caps, which are reputed to be of excellent quality and generally do not need replacement. I have tested a few and have found this to be the case. Thus most of the caps in this receiver are original.

In the R-390 (non-a) here, which is apparently a late Motorola model, S/N4700, I have had problems with mica capacitors. Micas are generally very reliable, but the "pink, square" style in this receiver look like they are candidates for further examination. I have replaced three, and believe there are others needing replacement in the RF stages.

The AVC caps, C546 and C547 (1 mfd, located in the IF section near V511 on the schematic) have a reputation for leakage. I disconnected one (they are in parallel) and gutted other case and replaced the insides with a 2-Mfd. cap.

Generally, many capacitors in the .0005-.5 MFd range are constructed of paper and aluminum foil. They become leaky and/or open with age. Bath-tub capacitors (not in an R-390 as far as I know, but popular in other receivers) are now showing up leaky. Performance really depends upon manufacture, with Sprague paper "Black Beauties" notorious as requiring replacement. Any wax covered capacitors are known offenders as are many molded plastic capacitors

As another general statement, one should NEVER turn on any equipment that has been on the shelf for 5 or more years without bringing up the set using a Variac. Hitting the set with 120 VAC is a good way to guarantee that electrolytic capacitors in the power supply will need replacement.

In short, capacitors can be generally considered suspect. In most receivers replacement of all cylindrical capacitors is appropriate, with a watch on micas. Filter electroytics may often be recovered by reforming using a Variac. While you are at it, make sure to test resistors. Typically, 10%or more of the carbon types in the set will have drifted 20% or more higher
in value and should be replaced. I found several open resistors in the R-390 power supply circuit. The power supply was non-operational until the resistors were replaced.

Date: Thu, 10 Jan 2002 08:13:21 -0500 (EST)
From: "Paul H. Anderson" <pha@pdq.com>
To: "Gregory W. Moore" <gwmoore@moorefelines.com>
Subject: Re: [R-390] Capacitor replacement when restoring

When doing replacement of caps be aware that the heat on the leads to posts that also go to resistors can cause the carbon comp resistors to drift. When I replace bad resistors, I check before and after and frequently have noted an additional 10% drift after removal. So, check resistances after replacing other components. I haven't done an exhaustive study or anything, but they certainly can change value quickly!

From: DAVEINBHAM@aol.com
Date: Thu, 17 Jan 2002 00:35:48 EST
To: r-390@mailman.qth.net
Subject: [R-390] Recap kit update

I have received 3 requests in the last week wanting to know if the recap

kit or the R-390A is still available. I am pleased to announce it is still available. I needed to buy some other parts for the company recently so I bought a few more capicators while I was at it. I now have 20 recap kits in stock for same day shipment. Half with in-the-can capacitors for C603 & C606, half with under-the-chassis capacitors. In case you have not noticed, the price of capacitors has increased lately. And tantalum capacitors have increased in price dramatically. I use a lot of tantalums in stuff for the company. Fortunately, there is only 1 tantalum in the R-390A recap kit. Even so, my profit margin on the recap kit is now thinner than a gnat's ass streached over a number 2 washtub (under $2). Bottom line, it will likely be necessary for me to raise prices after this batch of R-390A recap kits is sold. So, get 'um now before the price increase.

In regard to the long awaited recap kits for the R-390 nonA and the SP600, I am still working on them but they have had to take a back seat to my wife's medical problems. She has spent Christmas & New Years in the hospital and, in fact, had another major surgery today. I will get to 'em soon as I can. Regards, Dave

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Date: Fri, 01 Feb 2002 10:36:46 -0500
From: tbigelow@pop.state.vt.us (Todd Bigelow - PS)
Subject: [R-390] SBE, make of Orange Drops, to be sold...

Dave's post reminded me of something I thought might interest the crowd here. SBE (makers of the famous 'orange drop' caps) is in the process of being sold, or it may even be finliazed by now. When my pal who works there told me this, I was nearly in a state of panic, but he reassured me that the new fellow intends to keep things just as they are and even(hopefully)improve business. Seems the new owner-to-be is also a ham, so I'm going to see if I can catch up with him at some point for a chat about products. Apparently Perry Browning(the previous, or soon to be previous owner)is staying on for a while to help out. Perry is the one who created SBE from the remains of Sprague's Barre, VT plant and took over the orange drop line as well as others.

So, while our beloved OD's appear to be safe and in good hands, I was reminded that they are but a small part of the business. I'm not sure what else they sell, but a lot of items I'd guess. Sure would be nice if we could get 'em to make the twist-lok electrolytics again, huh?

I'll dig around for the email to see who the new owner is, if anyone is interested. I think he had a 7 or 8-area call, not that this indicates where an op is from anymore. But I won't go into that...

From: "Fraser Bonnett" <fraserbonnett@adelphia.net>
Date: Mon, 8 Apr 2002 23:18:44 -0000

Subject: [R-390] Replacement Caps

OK, so I screwed up my courage (let's hope that's all I screw up!) and removed the IF deck from my R-390A, with the intention of replacing C553, C547 etc (basically the ones usually identified as problem caps) The problem caps seem to be Sprague Vitamin Q's, which I intend replacing with Orangedrops. However, there are a bunch of other caps which look like brown versions of Black beauties. Do I assume correctly, that it would be wise to also replace those with Orangedrops?

From: Llgpt@aol.com
Date: Mon, 8 Apr 2002 19:40:13 EDT
Subject: Re: [R-390] Replacement Caps

.....replace those with Orangedrops....Fraser, W3UTD

YES

Date: Mon, 08 Apr 2002 13:21:15 -0300
From: "Guido E. Santacana" <laffitte@prtc.net>
To: r-390@mailman.qth.net
Subject: [R-390] Tantalum or not Tantalum

Hi Gang, Just a simple question. Is it better to replace the famous 8uF cap in the audio section with a tantalun cap or just a normal electrolytic?

Subject: Re: [R-390] Tantalum or not Tantalum
From: "Roger L Ruszkowski" <rlruszkowski@raytheon.com>
Date: Mon, 8 Apr 2002 10:49:15 -0700

..... Just a simple question. Is it better to replace the famous 8uF cap.....

Cap technology has come so far since the 1950's there are many wonderful new caps that will work. Today the question is how much cap can you get into the space? The replacement need not be a 8, a 10 - 20 will work very nice. It need not be any magic kind. What ever you can find with Axial leads. Check this against the schematic. I think it is a cathode bypass cap. I was rated at 250 volt in case the tube shorted. If the new cap is not going to splatter acid all over the place if it fails, it need not even be rated for the full voltage. If the tube does short a low voltage (50volt) cap will fail. If your going for exact historical replacement then you need the real time. If your going for functionality, then any 8 - 25 at 25 or more volts that fits in the space will work.

From: David Wise <David_Wise@Phoenix.com>

To: r-390@mailman.qth.net
Subject: RE: [R-390] Tantalum or not Tantalum
Date: Mon, 8 Apr 2002 11:05:00 -0700

Electrically, it doesn't matter in the least. You can put in anything you want, tantalum, aluminum, whatever, as long as it's 8uF or larger, with a rated voltage of 6V or more. when I have to do one, I'll probably use a 22/16 axial-lead aluminum, since I have many of those. The temperature under the AF deck is fairly high, so best would be a cap rated for long life at 105 deg C.

From: "Ed Tanton" <n4xy@earthlink.net>
Subject: RE: [R-390] Tantalum or not Tantalum
Date: Mon, 8 Apr 2002 15:38:56 -0400

I disagree... there is a significantly different (lower) ESR for tantalums from 'regular' electrolytics. This could affect the loading on whatever stage is driving through it. While it probably wouldn't matter, I feel the more conservative approach would be to use the same type as the designers intended-e.g. a 'regular' electrolytic.

From: "Ed Tanton" <n4xy@earthlink.net>
Subject: RE: [R-390] Tantalum or not Tantalum
Date: Mon, 8 Apr 2002 16:12:15 -0400

Hi Guido... somehow I THOUGHT it was a coupling cap... as a BYPASS cap, a tantalum would probably do a better job-but I also never argue with success!!! So, if a 'regular' cap is working fine, that's fine by me!

Date: Tue, 09 Apr 2002 06:46:22 -0300
From: "Guido E. Santacana" <laffitte@prtc.net>
To: r-390@mailman.qth.net
Subject: [R-390] tantalums

Thanks to all who responded to my inquiry about tantalum vs common electrolytics to replace the 8uF cap in the audio module. It seems that electrolytics will do well and that is my perception from the list. My EAC is working so well that I have done only partial electronic restoration. Now I have to remember if I ever replaced the IF caps in this one specially after seeing the post mortem of the mechanical filters.

From: Helmut Usbeck <vze2gmp4@verizon.net>
Subject: Re: [R-390] Tantalum or not Tantalum
Date: Tue, 9 Apr 2002 14:25:43 -0400

Tantalum caps are a type of electrolytic. Replacement with a regular electrolytic is OK. Or as I did in my 390a I left it out. This

produces a bit of local feedback and reduces distortion. The gain loss isn't noticable.

From: "John Saeger" <john@whimsey.com>
Date: Sat, 1 Jun 2002 12:50:03 -0700
Subject: [R-390] capacitor analysis

Well, I'm still thinking about which capacitors I'm tempted to pre-emptively change in my R390A so I've made a list along with their function. Maybe this will help decide what kind of capacitors would be good to use as replacements. I started out with the list on Nolan's page.

My feeling is that if a capacitor is a bypass capacitor, it's not that critical. As long as there is enough capacitance, a high enough voltage rating, and good enough quality and reliability, they could be just about anything. Orange Drops are great for the small ones. Nothing wrong with them. But I think other less expensive things will also work just as well in these positions. Polyesters or even ceramics. For the 2uf paper and the 8uf tantalum, I'm likely to use big polyesters. I'd make the electrolytics polyesters too if it wasn't so expensive to do. For now, I think I'm stuck leaving them electrolytic.

The capacitors that pass signals matter more. The famous C553 IF signal capacitor is probably the most interesting case. Maybe a low-dissipation factor polypropylene like an orange drop could make an actual difference in the performance of the receiver. Maybe. My guess is that the receiver has plenty of gain, and the signal to noise ratio as well as the gain of the vacuum tubes in the signal path make much more of a difference. And since so much is at stake if this one goes bad, I think quality, and overkill in the voltage rating is the way to go. I haven't decided for sure what to do with this one, but I kinda like the idea of a 2KV ceramic here. Maybe even a 3KV.

The audio stage is very interesting as well. And I think that maybe here is where the mandate to make it cheaper really took it's toll. They started out on the right foot with C531, which is in the IF deck by making it a 0.1uf. But then things went downhill. Personally, with the possible exception of C601 which is the negative feedback capacitor, I'm tempted to make them all big. At least 0.1uf. But maybe even bigger. Maybe 1.0uf polyesters if I can fit them. I might leave C601 at 0.01uf since by having poor bass response in the negative feedback, one might get better bass response by leaving it small.

So there's my 2 cents. But since I haven't actually done anything yet, I'm still very interested in other opinions. And if I've labeled any of the functions wrong, I'm interested in hearing about it too.

Here's the list:

Main Chassis

C101 0.22uf paper 100V bypass
C103 50uf electrolytic 50V bypass
C104,C105,C106,C107 .068uf paper ??? bypass

RF Amp

C227 0.047uf paper 100V bypass
C256,C309 0.1uf paper 200V bypass
C275 0.033uf paper 300V bypass

IF Amp

C504,C505,C517,C521,C528,C536,C538,C543,C547,C548
0.1uf paper 200V bypass
C529,C533,C534,C541,C545 0.033uf paper 300V bypass
C531 0.1uf paper 200V AF signal
C549 0.01uf paper 300V AF signal
C551 2.0uf oily paper 500V AGC time constant
C553 0.01uf paper 300V IF signal

AF Amp

C601 0.01uf paper 300V AF signal (negative feedback)
C602 0.033uf paper 300V AF signal
C603 3x30uf electrolytic 300V bypass
C604,C605,C607,C608 0.01uf paper 300V AF signal
C606 2x45uf electrolytic 300V bypass
C609 8uf tantalum 30V bypass

Thanks, John

Date: Sat, 01 Jun 2002 04:22:24 -0400
From: Helmut Usbeck <vze2gmp4@verizon.net>
Subject: Re: [R-390] capacitor analysis

If you change the caps to 1.0uf you might end up with some motorboating at higher volume settings. This happened to me when I did my audio mod. Switched back to 0.1 uf and everything was back to OK. The real bottleneck is the response of the output transformer. (among a couple of others) Try www.zorkler.com for an audio mod in the local part of the deck. regards, Helm. WB2ADT

Date: Sat, 01 Jun 2002 16:34:20 -0400
From: JAMES T BRANNIGAN <jbrannig@optonline.net>
Subject: Re: [R-390] capacitor analysis
To: John Saeger <john@whimsey.com>, R-390@mailman.qth.net

More 2 cents..... Except for electrolytics, black beauties and C-553, I see no reason to replace good parts in a functioning radio. That said, after all the work to identify and remove a component, it is a false economy to replace it with a cheap substitute. I have also learned, the hard way, not to re-engineer Collins radios.

From: "John Saeger" <john@whimsey.com>
Subject: Re: [R-390] capacitor analysis
Date: Sat, 1 Jun 2002 22:49:57 -0700

Yeah, if it ain't broke don't fix it. I agree. But there's still something flaky about my radio. So today I finally pulled it out of it's case and had a look at things. The bottom where the audio deck is was spectacular. Pristine. The gear work on the band switch stuff looked clean and things turn pretty smoothly. Maybe some lubrication would be nice, but I'm not in a hurry. Sometimes too much lubrication is worse than too little. I took out the audio deck and it looked great. It's a 1956 Motorola, and it's amazingly clean and I could find no traces of repairs. The rectifier tubes had been replaced with solid state plugins that were nicely potted. They looked commercial. So I don't think I can bring myself to spoil it since everything looks so nice. And I don't think the problem is here anyway.

The IF deck is another story. It's pretty ugly, and to tell the truth I suspect the problem is here. When the radio flakes out, the carrier level drops. But it doesn't happen very often. And it doesn't last very long. I hate these intermittant kind of problems, they're almost impossible to find. It just feels like a capacitor somewhere to me. I could be wrong of course. The IF deck is an old Collins. There are no adjustable tuning capacitors near the mechanical filters, and one of the filters had been replaced with a Dittmore Freimuth filter. When I looked at C553, and also at Chuck Rippel's page showing how to change it, I see that although it was an original looking Vitamin-Q, it was not dressed against the chassis like he shows in his picture. So I'm thinking maybe it has already been replaced before. But I went ahead and put in a 1KV ceramic, because it's what I had, and it didn't seem to make any difference. I don't know. Maybe later I'll put in something better after I order capacitors. Or maybe I won't. I don't know
why I like ceramics so much. Maybe because *ceramic* sounds heavy-duty. ;-) But I have a hard time paying twice as much for an orange drop than a Cornell Dublier polyester, which is what I'm leaning toward right

now. You can get them in a 1KV rating. But I'm still thinking about it...
Thanks, John

From: "Walter Wilson" <wewilson@knology.net>
Subject: Re: [R-390] capacitor analysis
Date: Sun, 2 Jun 2002 08:20:13 -0400

I guess I don't understand what the big deal is. You can replace every paper capacitor in the R-390A plus the tantalum for about $30 or so. And when you replace them all, you're going to invest many hours doing the replacements. If you are going to all the trouble to replace them, why worry about saving $15.

Below are a few items from others that have been posted to this list previously. I hope this helps you make your decision. Just be careful not to redesign the radio too much. [;-)

1) Ceramic capacitors tend to have hysteresis and other problems. What's that mean? It means their value changes slightly with applied voltage. So their capacitance "wobbles" around applied audio and DC voltages. The high-K, high value ones also have a lot of long-term capacitance drift, up to 10% over years. None of this take away from the fact that ceramics are an excellent choice for bypassing, and RF coupling use and the low-K and NPO ceramics are excellent for use in RF tuned circuits. But for the reasons I've stated, they're not the best choice for use in an audio path.

2) Replace bypass caps with film (any type) or ceramic (any type).
Replace coupling with film (any type) or ceramic (any type).
Replace tone controlling with film of any type.
Replace power supply filtering electrolytic with voltage rating of 100% or greater than original and 100-200% of capacitance.
Replace high stability with mica, *polystyrene* film, or stable ceramic (NPO or COG).
Replace temperature compensating (only if ABSOLUTELY NECESSARY) with same temperature characteristic ceramic.
Replace safety types with identical AC rating.

3) Not all poly capacitors are made equally.First there's that soft case of some, and the internal construction. Some have extended foil for extremely low inductance (Orange Drops), some don't. Some have different thickness of dielectric giving different reliability factors. The original capacitors were not extended foil and were not so effective as RF bypasses as IF bypasses. Besides`I've been using Orange Drops for at least 40 years and still find them reliable. I don't know about the others that haven't been made that long.

4) I always test all replacement caps for leakage at full operating voltage and for value before I install them. I'm never had a new orange drop or CDE cap fail.I have with others. As much trouble as it is to recap something like the IF deck,there's not a shot in hell that I'd try to save a couple of dollars and use a lesser grade of capacitors. You only talking about 18 or 19 axial leaded "paper"caps. I think that the current average price on the 400 and 600V OD's from Mouser right now to totally recap the IF deck is under $20.00. I'd spend the $20.00 on the OD's even if the other caps were totally free.

5) Sure you can replace SOME paper capacitors with disk ceramic but you have to face some consequences.0.1 at 400 volts is a value I've never seen in a disk ceramic. Plus the very large values in disk ceramics have a very high temperature coefficient of capacitance,negative.I've found them to lose as much as 85%of their room temperature value being close to the base of a tube. Further they have low inductance which is generally good,except that ordinary paper capacitors can be close to series resonance at 455 KHz and actually show a lower impedance in the bypass than the same capacitance (neglecting the effects of heat) in a disk ceramic.

From: "John Saeger" <john@whimsey.com>
Subject: Re: [R-390] capacitor analysis
Date: Mon, 3 Jun 2002 10:41:20 -0700

O.K. This makes a lot of sense. I shouldn't worry about cost so much. I'll probably go with the OD's almost everywhere for their *proven reliability*. What still concerns me is C501, a 5000pf ceramic which is smack dab in the middle of the IF signal path. It's a shame to put something as nice as an orange drop at C553, when we have a cheapass ceramic right in front of it. Should I also replace C501 with an orange drop? Or since cost is no object, should I consider replacing both C501 and C553 with mica's (available from Mouser) which have dissipation factors that are at least an order of magnitude lower than even the mighty orange drop?

From: "Chuck Rippel" <R390A@R390A.com>
Date: Tue, 4 Jun 2002 14:56:02 -0400
Subject: [R-390] Capacitors

Walter is absolutely right. I get e-mails nearly daily about replacing capacitors wholesale. There are not that many that need replacing. Remember, unlike other Collins designs such as the 75A-4, there are no capacitors (except in the audio stages and C553) that couple the grid of one stage to the plate of the preceeding stage. Thus, serving as plate block caps. These are under the most stress. That problem is circumvented by

design in that the R390A is largely interstage transformer coupled. They also fail and often. The problem usually first appears as a "popping" on strong signals. Don't get to "enthusiastic" replacing parts, you may do more harm than good.

From: "Bill Smith" <billsmith@ispwest.com>
Subject: Re: [R-390] capacitor analysis
Date: Tue, 4 Jun 2002 15:21:47 -0700

I found one (ceramic cap) in a Bauer AM Broadcast transmitter. I put a 'scope probe on a screen of a driver tube and found RF. Replaced the 0.01 Mfd cap and the RF went away. Tested the ceramic cap on a capacitor tester, and it didn't look all that bad. Pretty scary. BTW, have several pre-punched paper tapes in round metal cans. Don't know what is on the tapes, but they look like they have been stored for a while.

From: "John Saeger" <john@whimsey.com>
Subject: Re: [R-390] Capacitors
Date: Tue, 4 Jun 2002 23:54:48 -0700

> Don't get to "enthusiastic" replacing parts, you may do more harm than good.

O.K. I think this settles it. I've replaced C553. I'll leave it at that for now and proceed with caution. Thanks!

From: "Scott, Barry (Clyde B)" <cbscott@ingr.com>
Date: Mon, 10 Jun 2002 08:05:42 -0500
Subject: [R-390] Cap Request

I'm now the proud owner of my second R390A. I've examined the AF and IF decks and see the need for some capacitor work. Does anyone have any suggestions for good axial caps to replace black beauties, etc.? I did a DaveInBham cap kit for my Motorola and it works great, but some of those ODs were a royal pain to fit in place due to their being radial-leaded rather than axial. I was hoping to find something a bit easier to work with for this radio. I don't mind the waxy type if they're good quality. Any suggestions?

From: "Bill Smith" <billsmith@ispwest.com>
Subject: Re: [R-390] Cap Request
Date: Mon, 10 Jun 2002 10:01:20 -0700

Bob's Antique Radios. He doesn't charge shipping, just send him a check, and he sends you capacitors. They usually arrive surprisingly quickly.

http://www.radioantiques.com/index.html

He sells yellow, axial tubular mylar capacitors. They are made it Japan and seem to be of excellent quality. They are of common values only, and sold in lots of 25, but at $8.00 or less a package, they are a bargain.

From: DAVEINBHAM@aol.com
Date: Mon, 10 Jun 2002 23:18:17 EDT
Subject: [R-390] Easy to install Capacitors

You will note in my ads for the ReCap kit I say " Orange Drops or equivalent'. If you want easy to install capacitors ask for the "Equivalents " when ordering. They are somewhat smaller than Orange Drops, have a slightly higher voltage rating and more flexible leads. I got turned on to these little goodies some years back when doing some work for NASA. I usually have them in stock as I use them in the medical stuff I make. Also I have used them in my own R-390A's. If I said I thought they were better than Orange Drops some of the old timers on this net would want to tar & feather me so I won't say that.

From: "Chuck Rippel" <R390A@R390A.com>
Date: Wed, 12 Jun 2002 16:20:09 -0400
Subject: [R-390] RE: Caps

>Unfortunately, they are not from Japan but they are from China.

And that is a very good reason not to purchase them.... I use 100% SBE Orangedrops and they not only fit fine, but are very high quality. Especially the type 716P's. They are also made in the USA, specifically, Barre, Vermont and not Nan-Chung. Antique Radio has a full assortment.

From: "Chuck Rippel" <R390A@R390A.com>
Date: Wed, 19 Jun 2002 12:54:11 -0400
Subject: [R-390] R390A Problem

Hey, I am a Drake person also. My first "store bought" radio was a "C" Line. I just finished re-doing a very late model "C" Line for myself and its near factory perfect. With regard to the blocking cap the problem does not occur every day but its very destructive when it does. I happened to me about 12 years ago and I lost a 4kc filter to it. If you want some additional background, go on my R390A WWW Site and look at:
http://www.r390a.com/html/C-553.htm

It describes the cap/filter problem in detail. Replace the original cap with a 600V .01uv SBE Orangedrop. If you don't have one, send me a 2 bucks and I'll mail you one. Orangedrops work great at 455kc and below.

You can tell who built the radio by looking at the mfg markings on the

side of each module. The contract/builder history is here:
http://www.r390a.com/html/Ordernumbers.htm

Tom Marcotte N5OFF sells generic front name plates. I am sure someone on the list has his current e-mail address. I'd enjoy an off list discussion about Drake if you get the chance.

From: "scott" <polaraligned@earthlink.net>
Date: Thu, 11 Jul 2002 18:15:49 -0400
Subject: [R-390] Some interesting info.

I thought this was a really good post on cap longevity. It makes me wonder if my grandkids will be able to keep all my old radios running. Check it out below.
Scott

John Gibson <gibsonj@mindspring.com> initially asked:
> ..... I have always replaced the leaky waxed paper caps in vintage radios with polyester caps thinking that they will last forever. But is this true? Has any estimate been made of their lifetime?

Arden Allen <gumbear@pacbell.net> then answered: Does anything last forever? and continued with anecdotal evidence of the longevity of modern film capacitors. He then concluded:

> Beings the film is a relatively pure substance, free from
> internal degradation, I believe only extreme heat would
> lead to destruction. They would essentially have to melt
> and then short out as opposing plates come in contact
> with each other or the melted plastic shorted through
> from electrostatic stress and physical distortion. I
> think your leakage worries are over for the next
> millenium or two.

Having spent most of my career involved in manufacturing polyethylene terephthalate polyester (PET, Mylar® is DuPon'ts variety), polypropylene (PP) and polytetrafluoroethylene (PTFE, Teflon® is the most common variety), and been involved in a few research projects on other newer materials occasionally used in capacitors such as polyphenylene sulfide (PPS), polyethylene naphthalate (PEN), and cyclohexane dimethanol modified polyester (PETG), I think I can address this issue. I also am familiar with polystyrene (PS) and polyphenylene oxide (PPO) materials. Of these, the PS and PTFE capacitors tend to have specialized uses and are not often found. The PPS and PEN materials are relatively new and I expect to see more of them in high temperature applications. The PETG material was investigated for film capacitors at least 30 years ago and

found to have some advantages over conventional PET, but Eastman management decisions prevented further development. It is being looked at again today. So this leaves the conventional PET and PP materials for most of the film capacitors we can find today.

Polypropylene is a good dielectric material with quite low losses at higher frequencies, buts its low temperature rating limits its application in many circuits. The lifetime of polypropylene capacitors should be exceptional as long as they are not overheated.

Polyester capacitors have greater dielectric losses, especially at high frequencies, but having a higher dielectric constant than PP and a higher temperature rating they are probably the most popular film capacitor material today. Their lifetime is probably somewhat less than polypropylene, but the term "forever" means different things to different people. Moisture will eventually react with the polyester structure to decrease its polymer chain length. It will also react with the heavy metal catalysts (typically antimony) to form ions which will increase the leakage in capacitor applications. The effect will be seen with wrapped foil capacitors long before it is seen with those whose electrodes are metallized onto the film (the aluminum metallization retards the diffusion of moisture into the polyester).

>From a practical viewpoint, even wrapped foil polyester capacitors will certainly outlive those reading this message - that is, if they are kept relatively dry and not overheated. Metallized polyester capacitors will last much longer. My guess is at least a few hundred years. Somehow I cannot be convinced to worry about what might happen to a Boatanchor a millennia from now!

Electrolytic capacitors are an entirely different story. They need moisture to function (normal room relative humidity is fine, but storage under exceptionally dry conditions will shorten their life). The so-called dry electrolytics are not really dry, they contain a paste that needs some moisture to remain electrolytically conductive. <snip>

From: DAVEINBHAM@aol.com
Date: Tue, 13 Aug 2002 14:27:34 EDT
Subject: [R-390] I still have a few ReCap kits available

Interestingly, I am still getting inquiries about the ReCap kits for our favorite radio, the R-390A. Right now I have 3 kits with in-the-can electrolytics and 6 kits for under-the-chassis electrolytics in stock and available for same day shipment.

Date: Thu, 15 Aug 2002 01:06:38 +0000

From: Philip B Atchley <ko6bb@juno.com>
Subject: [R-390] R-390A Capacitor question.

I have a friend who has two R-390A receivers that are supposed to be in good physical condition but has some electrical problems. He may be willing to give me one in exchange for re-capping and electrically re-furbing the other and I'll probably take him up on it (I've re-done 3 before). Time is of the essence in this job as he is moving between the 13th Sept and the end of Sept... I have a early "proof" copy of the "modified" service manual that was done by the good folks on this list so I'm all right in that department. Obtaining Parts is likely to be the bottle neck here.

QUESTION 1: At one time There was a gentlman who offered capacitor "kits" containing all the paper capacitors etc in the set. IS THAT individual still offering them? NAME, price and time of delievery? Otherwise I'll probably have the man order everything from Mouser who is a single source supplier who is very good about speedy order fills.

QUESTION 2: Does somebody have a complete list of all capacitor values used in the R-390A to save me the time of having to go through all the parts lists in the manual (or maybe the manual has such a list, I haven't had time to check).

From: "wb5hak" <wb5hak@prodigy.net>
To: <r-390@mailman.qth.net>, "Philip B Atchley" <ko6bb@juno.com>
Subject: Re: [R-390] R-390A Capacitor question.
Date: Wed, 14 Aug 2002 21:18:01 -0500

Get hold of DAVEINBHAM@aol.com . I got my "kit" from him. It is well done, labeled, and should be an easy job. Not sure about delivery times, but he can tell you.

Date: Thu, 15 Aug 2002 00:03:10 -0400
From: rbethman@comcast.net
Subject: Re: [R-390] R-390A Capacitor question.

The kits are great! The delivery times have been pretty darn fast too! For my two R-390As, I have bought two kits at different times. Well worth it! Each cap or caps come in a ziploc bag listing the capacitor where it is to go, I.e., 0.01 - C610, etc.

From: "Jim Shorney" <jshorney@inebraska.com>
Date: Wed, 14 Aug 2002 23:22:51 -0500 (CDT)
Subject: Re: [R-390] R-390A Capacitor question.

FWIW, I just got my rebuilt main filter caps back from Chuck Rippel. One

word: incredible! I'll count this as some of the best money I ever spent.

Date: Wed, 14 Aug 2002 22:00:55 -0700
From: matt parkinson <mparkinson1@socal.rr.com>
Subject: Re: [R-390] R-390A Capacitor question.

Hey don't forget Walter Wilson he also has a great kit . Both Walter and Dave has to be the greatest guys on the R 390 and Collins list for help with cap kits and Walter can help walk you threw some hard problem with the R 390a Receivers. Am I plugging for both guys you bet . Give em a try you will be glad you did.

From: DCrespy@aol.com
Date: Sun, 25 Aug 2002 09:37:32 EDT
Subject: Re: [R-390] They followed me home <GRIN>.

Phil, a few notes (I hope will supplement Barry's good advice): <snip>

Regarding recapping. If the radios used Black Beauty plastic encased caps or their Brown equivalents, then I'd go ahead an replace them. I find some of them cracked allowing mosture to screw up the paper dielectric. If they are the metal and glass versions, I've had yet to find a bad one. Frankly, in either case, in my R-388 / R-390A (and other Collins) restorations I have had more trouble with defective postage stamp micas, than with the coupling/bypass caps most folks replace. Look for bad mica caps anywhere they are in the B+ line (in plate circuits). Regarding trouble with certain bands, you got some great advice from Barry on this. Check the band crystals, their connections and their trimmers. Also, if the problem is all bands below 8mHz, it is the crystal oscillator on the RF deck.

From: "Bob Camp" <ham@cq.nu>
Subject: Re: [R-390] No "Depot Dawg"
Date: Tue, 27 Aug 2002 02:49:43 -0400

Hi, I guess this is what makes it a hobby. I would vote with you - a unit that is "all original" is slightly cooler than one with mixed modules. That's not to say better or more functional, just cooler. Needless to say this issue has come up before. Of course with very few exceptions (say 10 radios) there is no way to *ever* prove that a radio is original so you never really know.

The metal/glass package capacitors are better than the black plastic package ones. The yellow plastic wrapped ones are Mylar (or similar) with a plastic insulation. About the only disadvantage to the yellow ones is that when you hit them with a soldering iron they melt.

The thing that makes the black or brown caps a problem is that the insulation is paper (or paper with mica in it). The stuff soaks up humidity and then they get leaky. The whole process really gets going when the case splits open.

Leaky capacitors aren't all that hard to check. You can use a fairly simple setup. Get as sensitive a meter dc meter as you can find. A good old Weston or Simpson analog meter works well. If you can find something in the 10 or 20 ua range that should do. Then set up about a 100 volt power supply. Stacking two 48 volt units is one approach. One microampere at 100 volts works out to 100 meg ohms. A 10 meg ohm series resistor will keep you from blowing out the meter. New from the old box plastic capacitors will all read "no deflection" on the meter. Every black or brown body cap I have ever checked reads at least a couple of micro amps.

If you have a doubt about a type of capacitor find one that you can pull one end on. Hook up the tester and see what it reads. If it's ok then solder that end back in. On the truly bad stuff you won't be able to find one good one ..... Both the green and brown switch wafers will soak up de-oxit. The brown ones swell up a bit more, but they both retain the stuff. In either case it's probably not a good thing, but nether are dirty contacts.

One thing you might do while you have the RF deck out of the radio - meg out the AGC line and see what it reads. I have never tried it but each time I put a deck back in I kick my self for not thinking of it. I have no idea what it should read, but the schematic should be fairly easy to follow.

Date: Wed, 28 Aug 2002 18:38:45 +0000
From: Philip B Atchley <ko6bb@juno.com>
Subject: [R-390] Them Orange Drops are big....

Hello all Well, I'm perhaps 3/4 of the way through the recapping of my R-390A. Even though this receiver had "mostly" either the yellow Aerovox or metal/glass capacitors (With only 3 "Brown Beauties") I decided to go ahead and replace all the paper and 'lytic caps.

My philosophy is that 400 and 600 Volt caps are far less likely to fail and cause damage than the 200 and 100 Volt caps that were in the unit. And I already had all the replacements except for the .033uF, 2uF and 'lytics which are on order. And yes, I'm replacing that large oil filled can as two of my previous (Motorola) units had AGC problems associated with this capacitor. I don't wish to take chances as once I put it in the listening post I don't desire to have to constantly pull it out for further troubleshooting.

But boy, those 400 Volt 0.1 uF Orange Drops are much larger than the originals. I also had a bunch of 630 Volt "Blue Drops" that I used in many places as they are "flatter" and fit better in many places. In the last 3 R-390A's I recapped (1 Collins and 2 Motorolas) I used the little brown capacitors from Mouser and they seem easier to fit in tight places.

Of course I used a 600 Volt .01uF capacitor for coupling to the mechanical filters.

From: "Drew Papanek" <drewmaster813@hotmail.com>
Date: Wed, 28 Aug 2002 17:02:47 -0400
Subject: [R-390] Re: Depot Dawg / Capacitor leakage test

In his response to your concerns about capacitors Bob Camp mentioned a setup for leakage testing using power supply, current limiting resistor, and microammeter. Chances are you already have the meter with the current limiting resistor built in.

It is your DVM or VTVM (Zin=11 meg). Use the meter in the dc voltage mode. The leakage current can be calculated as Vmeter/10 meg. The good thing about this test is that it is even more sensitive than the one Bob mentioned.

For a detailed description (and debate on all facets of R-390x capacitors) goto R-390a.net. Select References>Pearls of Wisdom>Recapping. On pages 99 and 100 there it will be, along with much other fascinating reading.

From: N4ue@aol.com
Date: Wed, 28 Aug 2002 18:25:09 EDT
Subject: [R-390] cheap HV p/s

I have used the HV p/s and VTVM method since Dr. Jerry told me about it. It works perfectly. An excellent HV p/s is the one in the old Heathkit cap checkers. They can be had for almost nothing..... Unless you check a cap at rated DC voltage, it means little. All the bypass (and some of the coupling) caps in my 75A-4 checked perfectly on my NIST calibrated cap tester, (checks value only). They were all nfg at voltage. Yes, it does make a difference! The A-4 really sounds perfect now.

Date: Wed, 28 Aug 2002 18:45:09 -0700 (PDT)
From: Rodney Bunt <rodney_bunt@yahoo.com>
Subject: [R-390] Depot Dawg / Capacitor leakage test

The maximum voltage would be the "battery" inside the DVM say 9v. Only a really bad 200v capacitor would leak at 9v !!!

I have a Heath C3 Capacitance tester, and you can wind up the test volts to 450v and observe leakage on the magic eye tube as "noise" it is interesting to note how much more noise there is as you wind up the volts closer to the operating voltage.

Have a re-think about this as a testing aid. I got the Heath C3 tester on ePay for $30, best investment I ever made, I have found capacitors that looked OK with the DVM, but were leaky at high voltages.

From: "Bill Smith" <billsmith@ispwest.com>
Subject: Re: [R-390] Depot Dawg / Capacitor leakage test
Date: Wed, 28 Aug 2002 23:32:26 -0700

Here is a test I use with the Simpson 370 VOM (what else is there to use with an R-390, or any other receiver, for that matter!). It is only a 9-volt test, but works well to identify obviously bad caps.

1. Switch the meter to measure x 10,000 ohms (high ohms scale).

2. Put the meter leads across the capacitor (must be at least .01 mfd. or greater value, out of circuit, or in a dead-end circuit).

3. Watch for a "kick" as the capacitor charges. If the capacitor is leaky at 9 volts, some resistance will be indicated. Of course it is worse at higher voltages.

4. Disconnect one probe, wait a second or two and connect the probe again. If the meter kicks again, even slightly, internal capacitor leakage has been enough to discharge the capacitor. It is likely bad at higher voltages.

5. This is a quickie test. Best test is at the rated voltage of the capacitor, but the VOM test can save a lot of time. If it fails, the capacitor will always fail the high voltage test.

6. I am not sure tests are all that valuable. I have had sets work well for the first several hours, then capacitors have deteriorated. With few exceptions, if I suspect caps are bad, out they go.

The Vitamin Q caps in the R-390 are one of those exceptions, they seem to be holding up fine. Unless manufactured within the last twenty years or so, oil (bathtub) capacitors, however, are now going bad.

Have a GR Wave Analyzer with 21 of them. :-(

From: "Drew Papanek" <drewmaster813@hotmail.com>
Date: Thu, 29 Aug 2002 13:55:02 -0400
Subject: [R-390] Re: Capacitor Leakage Test

The leakage test to which I refer is the one mentioned by Dr. Jerry a couple of years ago. The DVM or VTVM is set to the VOLTAGE mode and connected in series with high voltage power supply and capacitor under test. The meter reading is interpreted as leakage current by dividing by the input resistance of the meter. The meter's input resistance serves as a current limiting resistor. The maximum voltage across the capacitor will be that of the power supply minus the meter reading. The meter will read high for leaky, low for non-leaky. If the cap has negligible leakage its voltage will be essentially equal to that of the power supply. This test with a DVM on the 3 volt scale would be very sensitive, having a full scale current of 270 nanoamperes. Drew

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From: "AI2Q Alex" <ai2q@adelphia.net>
Subject: RE: [R-390] cheap HV p/s
Date: Thu, 29 Aug 2002 14:45:33 -0400

Hi Ron! I read your note with interest, as I own one of those old Heathkit capacitor bridges. It's great for ascertaining values, (although I increasingly find myself using a digital handheld for that purpose these days). Can you kindly tell me how to use the "magic eye" on the Heathkit for testing breakdown and leakage? Might you have the original Heath instructions? Thanks in advance.

From: "scott" <polaraligned@earthlink.net>
Subject: Re: [R-390] Restoration of 1952 Collins # 252
Date: Tue, 24 Sep 2002 17:26:40 -0400

My 390's have the vitamin Q caps that are metal with glass sealed ends. I have heard some say that these never go bad. (I know...never say never...) Do you have these? and if so did you test for leakage on any of them?

Date: Tue, 24 Sep 2002 18:34:21 -0400
From: rbethman@comcast.net
Subject: Re: [R-390] Restoration of 1952 Collins # 252

The only thing even closely resembling one of these is the 2mf on the IF. It tests just fine. The AF deck caps test fine also.

From: "Bill Smith" <billsmith@ispwest.com>
Subject: Re: [R-390] Restoration of 1952 Collins # 252
Date: Tue, 24 Sep 2002 15:54:37 -0700

I won't say they will never go bad, but the R-390 here has Vitamin Q caps, and I haven't found any with leakage in this set. The two AVC oil-filled are doubtless leaky, however. Also, have replaced several leaky mica caps in the front-end RF cans.

From: "Scott, Barry (Clyde B)" <cbscott@ingr.com>
Date: Thu, 26 Sep 2002 09:01:49 -0500
Subject: [R-390] Orange Drop question

Can someone tell me how to determine which lead is connected to the outer foil on an Orange Drop capacitor? Some of them have stripes, but the ones I got yesterday don't have a stripe. Is it the right-hand lead looking at the cap from the "front" (readable) side?

From: DAVEINBHAM@aol.com
Date: Thu, 26 Sep 2002 13:49:25 EDT
Subject: Re: [R-390] Orange Drop question

Why don't you send the Orange Drops back to whomever you bought 'em from and demand replacements that are properly marked ? That is what I would do.

From: "Bill Smith" <billsmith@ispwest.com>
Subject: Re: [R-390] Orange Drop question
Date: Thu, 26 Sep 2002 11:09:33 -0700

They may be ok. The caps I use are "non-inductively wound" (don't know what that really means). At any rate, they are not supposed to have an "outside" and have no identifying stripe. I have never tested them to verify. Perhaps Orange Drops have adopted this construction approach. Are the caps you have marked with their capacitance value and voltage rating?

From: "Scott, Barry (Clyde B)" <cbscott@ingr.com>
Subject: RE: [R-390] Orange Drop question
Date: Thu, 26 Sep 2002 13:38:19 -0500

Yes, the caps are marked with their value and rating, so following Walter's advice (and what I was pretty sure of), I can install them properly. I'm pretty sure they're okay, they just don't always mark the outer foil side on their caps. I seem to recall a discussion that this isn't as critical with ODs as some other caps (refer to the "non-inductively wound" comment), but I don't know for sure.

This is an audio application, so I'm not even sure if this is a factor. The Black Cat caps I'm replacing are definitely marked and installed as per Walter's description of coupling capacitors. It probably wouldn't make

any difference in this application, but I like to be thorough.

From: "Glen Galati" <eldim@worldnet.att.net>
Subject: Re: [R-390] Orange Drop question
Date: Thu, 26 Sep 2002 12:51:35 -0700

I think we need to have the whole batch "X-Rayed". Could they be counterfeit "offshore" parts? Hmmmmmmm!

Date: Thu, 26 Sep 2002 13:17:53 -0400
From: Helmut Usbeck <vze2gmp4@verizon.net>
Subject: [R-390] Orange Drops

Over the past several years I've run into Orange Drops with several types of markings, not in just radio equipment. Being curious I checked SB electronics.com, one will see that there are quite a few different types of Orange Drops available now. Plenty of spec sheets to download. No more band. The right hand lead is still the outside foil. It goes to ground to help prevent noise and hum pickup. Yes, the outside foil postioning can be just as critical for audio as other circuits, don't understand why all of a sudden it's not. For general use around the shack on different projects, I been using a polypropylene cap with an IC logo and is yellow in color (Lemon drops?). They have worked quite well for me. Available from the usual places.

Date: Thu, 26 Sep 2002 19:16:51 -0400
From: Bob Camp <ham@cq.nu>
Subject: Re: [R-390] Orange Drop question

The main reason to mark the "outside" on a film capacitor is to make sure that the outer foil is at ground in something like a bypass application. This makes some sense if the value of the capacitor is small and the circuit is fairly high impedance. It also only makes sense on a wound foil rather than a stacked foil part. If the value of the capacitor is farily high then the couple of extra pf that you get to the outer foil probably will never be noticed. I don't think there is anyplace in an R-390(A) that would be a problem for this kind of thing. All the low value stuff is mica or ceramic. The film stuff is all large value.

From: ToddRoberts2001@aol.com
Date: Thu, 26 Sep 2002 19:50:43 EDT
Subject: [R-390] Orange Drop Question

<PRE>There is a method that can be used to determine which lead of an orange drop is the outside foil if the capacitor is not marked for this, or if it makes any difference. Take a high-gain audio amplifier and hook the

capacitor across the audio input. A small Radio Shack battery-powered audio amp works good for this. It is best to make up a dedicated input lead for this with a short length of shielded cable correctly wired to a plug for the input jack- with the cable shield wired to ground side. Connect the capacitor across the input lead - one lead to the shield and the other lead to the center or "hot" conductor. Now turn up the gain a bit and grip the orange-drop capacitor with a couple of fingers. If the outer foil is connected to shield ground you should not hear any rise in hum. If the inner foil is connected to shield ground you will hear a definite rise in hum level when you grip the capacitor body because now the outer foil is "floating" above ground. Not the most scientific method for determining this but one that works!

From: "Bill Hawkins" <bill@iaxs.net>
Subject: RE: [R-390] Orange Drop question
Date: Thu, 26 Sep 2002 19:50:35 -0500

Well, I'm torn. Should I be reassuring and say that it is the right hand lead from the printed side and let those who worry about this sleep well at night, when I know that the labelling equipment could mark it either way?

Or should I use that quote about fly specks and pepper?

Consider the construction of a plastic cap. A four layer ribbon is made up of a really thin strip of plastic, a strip of rally thin aluminum offset to stick out on the north side, another strip of plastic film centered over the other one, and a strip of aluminum foil that is offset to stick out on the south side. The ribbon could be 20 feet long for a 0.01 mfd cap or 200 feet for a 0.1 mfd bypass. Wind up the ribbon, mash leads into the foil sticking out at each end, dip it in Day-Glo orange goop, send it to the label machine, and the result is a capacitor.

Take that orange drop and wrap foil around the outside, taking care not to short it to the leads. Measure the capacity between the added foil and either lead. You will not be able to measure any difference with any practical instrument. The added foil is perhaps 0.2 feet long. It is separated from the outer foil by 10 times the thickness of the plastic film. This adds up to about 0.01% of the capacity of the thing you are using for a bypass or coupling capacitor.

Only a person who can hear the difference between silver and copper leads on a component should worry about grounding the outside foil. If one is incurably obsessive about this kind of thing, it would be best to build mu-metal shields for all of the parts. One drawback is that the chassis must also be mu-metal to establish a "ground" reference for magnetic fields as

well as electric.

From: "Drew Papanek" <drewmaster813@hotmail.com>
Date: Tue, 24 Dec 2002 14:42:01 -0500
Subject: [R-390] Re: Replacement C-551

There does not seem to be an exact fit new component (C-551) available. If you desire exact fit, you might try Fair Radio Sales for a used part. You can keep a semblance of original appearance (topside anyway) by disconnecting C-551 and leaving it mounted in original position. A compact modern replacement component can then be installed under chassis. The SBE Orange Drop series capacitor seems to be preferred by many on this list, but other caps will certainly work. I prefer the Cornell-Dubilier (CDE) DME series (available from Mouser Electronics) because its small size simplifies installation. I have cut the leads on these to about 1/8" and secured the part to the C-551 side of the underchassis partiton, leads facing out, using RTV. The leads removed from original C-551 are then wrapped and soldered to the 1/8" stubs on replacement C-551. While you're at it, the 0.1 uF cap going from one side of C-551 to ground can be replaced with a modern 400V (or better) rated unit.

The true hardcore purists have gutted C-551 cans and installed replacements inside. This requires a torch, patience, and a liking for the smell of burning carcinogenic PCB-laden oil.

This would be a good time to also install the Dallas Lankford 2-diode AGC mod. This simple and easily reversible modification makes a night-and-day difference for reception of SSB signals. Most of the improvement comes from installing just the diodes; it works very well without the rest of the procedure.

Check out r-390a.net , click on References, Pearls of Wisdom, SSB Conversion.

Date: Mon, 30 Dec 2002 11:30:55 -0500
From: Jim Brannigan <jbrannig@optonline.net>
Subject: [R-390] Finally!!!

It wasn't the great WEB sites, threads, curiosity or fountain of knowledge available. It was the interminable "how to send e-mail" discussion that finally moved me to pull my '67 EAC out of the rack, clear the workbench and start to work on it. The last time I had it open for an alignment was at least 10 years ago. After my back straightened out, I took off the covers and except for some dust and cobwebs, it is as clean as I remember it. There is a COSMOS PTO, a full set of black IERC shields and the power supply, Oscillator and IF decks are EAC. I can't tell about the RF module

until I pull it. Someone added a BNC jack to the rear panel. It is labeled "SM output" and RG-174 leads to the RF deck. Otherwise it is pristine. I could probably get away with a quick re-alignment, but I am going to replace the recommended capacitors, add a three wire AC cord and clean and grease the gears. I have replacements for the filter caps, they are sitting on a power supply reforming. I will inform the group on my progress.

From: "Jim Brannigan" <jbrannig@optonline.net>
To: "Bob Camp" <ham@cq.nu>; <r-390@mailman.qth.net>
Sent: Monday, December 30, 2002 7:23 PM
Subject: Re: [R-390] Finally!!!

> .....I don't believe in wholesale component replacement.....

Maybe a mistake. There is a capacitor that, if it fails, will take out your mechanical filters. And it HAS happened before!!!! I would replace this one no matter what. I would do a random check for leakage in the capacitors, especially if you have "brown beauties". I tested all of mine as I replaced them on a Sencore LC-73 analyzer and they all had BAD leakage. Nothing wrong with spending time with each module and checking all components. If in doubt, replace it. We own these radios to use them right? why not go the extra step to make it perform like the day it came out of the box? You certainly are not decreasing the value of the radio, but increasing your listening pleasure. I highly recommend Walter Wilson's rebuild kit as it replaces all problematic components and even includes a 10 turn carrier pot and a CL-80 inrush
current limiter.

Date: Tue, 31 Dec 2002 07:42:40 -0500
From: Jim Brannigan <jbrannig@optonline.net>
Subject: Re: [R-390] Finally!!!

I will be replacing the capacitors as recommended on Chuck Rippel's site. Looking at any "brown beauties" is a good idea. This radio has always performed well electrically. Mechanically the KC tuning is a little stiff and the MC tuning a bit sloppy. I will be using your excellent pictorial to work on the mechanical side.

Date: Tue, 31 Dec 2002 10:21:31 -0600
Subject: Re: [R-390] Finally!!!
From: blw <ba.williams@charter.net>

Some people like getting into the upper modules often, so maybe not replacing all of the problem capacitors is okay for them. I like tinkering with some things too. Still, there is that risk involved if you don't. Time

and again someone on the list is testing the brown beauties and most of them are out of spec. I agree with being safe and replacing them. Another advantage in replacing the paper electrolytics and black/brown beauties is that you will be reheating those ancient solder points. If you have the MFP coated modules, this is a good time to make sure the grounding points are scraped clean. This has been a source of problems too. Plus, Scott has a good point where you would be doing the radio a lot of good in terms of performance. Tubes are great, but old caps ain't. Dave in Birmingham also sells recap kits. I bought one a while back and it is a good deal. It is a good deal on prices, and I saved hours of time looking up parts. He sends them separated and labeled in bags. No fuss, no muss.

Date: Tue, 31 Dec 2002 14:49:00 -0500
From: Bob Camp <ham@cq.nu>
Subject: Re: [R-390] Finally!!!

The yellow Aerovox capacitors have a plastic dielectric in them. They are more reliable than the paper dielectric black or brown capacitors. I have pulled a lot of the paper parts out of R-390's and have yet to find one that is in good shape. I suspect that soak up humidity over time and that's the end of them. I have yet to see anybody come to the defense of the paper filled caps. I would replace them wholesale with plastic dielectric parts.

From: "Scott Seickel" <polaraligned@earthlink.net>
Subject: Re: [R-390] Finally!!!
Date: Tue, 31 Dec 2002 16:56:00 -0500

The Aerovox are more reliable but I knew there was reason to be cautious about them also. I searched the archive and found this post from Nolan. (This should make Joe happy, read post below). The bottom line, I think, is that it is NOT unreasonable to just recap the whole radio. An ounce of prevention is worth a pound of cure. Caps just have a high rate of failure no matter what they are made of. If you don't recap, you may have a failure that does damage to other components of your radio. The very expensive and hard to get filters are just one item that can be ruined.
Scott
>>>>>>>>
Date:Tue,06 Oct 1998 02:31:38 -0500
From:Nolan Lee <nlee@gs.verio.net>
Subject:[R-390] R390A paper capacitors

I just removed all three of the paper/tubular capacitors from the RF deck of the EAC.This is a very low mileage "cherry"deck with the original tubes.Using a loupe,I noticed that the "brown beauty of death"had a microscopic split about a half an inch long down one side just like most of the ones I'd looked at.I threw it on the RC bridge and couldn't get a solid

value.It did slightly "dip"at about‡¥äCapacitor Replacement Tips page 13 0.033mf.I tried a leakage test.Almost a dead short above about 50 volts or so.I haven't found one of these style capacitors yet that was good.Maybe it's the humidity here or just bad juju. I tried the two yellow 0.1mf 200V Aerovox capacitors from under the crystal oven.Only a slight "dip"of an indication of the value on either of them. One leaked like hell at voltages about 30 volts and the other broke down totally at about 100 volts or so.Granted,one of them is only used help kill the static from the 6.3V oven cycling on and off and would have probably continued to work for decades to come,it was bad.I've been testing all of the caps that I've been replacing.Maybe 10 to 20 percent of the hermetically sealed Vitamin Q style ones won't meet spec.None of the "brown beauties of death"will even come close and about a third to half of the yellow Aerovox ones are bad. A lot of people questioned my replacing of all of the capacitors.I'll stand by my decision.These tests have reinforced my opinion that if you remove a module from an R390A,to work on it,replace all of the original paper caps in it before putting it pack in the radio .If you don't want to replace them all,at least make sure that you replace the brown tubular ones.Only a couple of three dollars and you've eliminated a possible cause of flat out failure that could cause damage to something expensive and a pain in the ass to change or at the least,decreased performance.

From: "Kenneth G. Gordon" <keng@moscow.com>
Date: Tue, 31 Dec 2002 17:14:03 -0800
Subject: Re: [R-390] Finally!!! Re-capping...

> Ya' all are wearing me down on the total capacitor replacement...

Gee...with all this effort on our part I certainly hope so! ;-)

>If I don't replace them and the radio has a problem, I'm gonna' get 500 e-mails telling me "We told you so".....actually the Aerovox's look OK, but the disc ceramics look beat...

IMHO, replace them all. You will be mighty glad you did.

From: "Jerry Kincade" <w5kp@direcway.com>
Date: Sat, 4 Jan 2003 18:41:07 -0600
Subject: [R-390] IF deck caps

I know the failure rate of Black and Brown Beauties, but do the yellow Aerovox jobs suffer a high failure rate too? I ask because I just (groan) looked at the nearly 20 of them packed into the underside of this Teledyne IF deck that will require replacement if ALL the paper caps must be changed out. Some of them are pretty well buried. My other 390A, which was gone over prior to my purchase by a fairly well known rebuilder, had

only C-553 and the BBOD's replaced, all the original yellow Aerovox's were left in. Was this a bad move on the restorer's part? That particular radio has worked like a champ for 3 years now.

Date: Sat, 04 Jan 2003 20:20:52 -0500
From: Jim Brannigan <jbrannig@optonline.net>
Subject: Re: [R-390] IF deck caps

I'm in the middle of doing some TLC to my '67 EAC. So far I have only replaced the "Rippel" suggested Caps. I'm hearing some "popcorn" noises and am far more concerned about the 0.005 1KV coupling caps.

Date: Sat, 04 Jan 2003 21:09:45 -0600
Subject: Re: [R-390] IF deck caps
From: blw <ba.williams@charter.net>

Are you talking about wax covered paper caps? If so, these have to go. They leak badly. These are good candidates for reforming as you bring a variac up slowly, but you will probably find a high number of them out of tolerance. These get pinhole leaks in the foil innards. You reform them by bring up the voltage slowly and the holes get filled again.

But, you can guess the probability of failures soon with that many of them in there. Pull those wax covered paper caps out carefully and put them up for sale on ebay. Advertise them as excellent dummy caps for the *L@@K* crowd who cover modern caps with the shells of old ones to make it look *ORIGINAL*. Don't laugh, a lot of people do this. I was just reading an old article about a guy who forms his own square molds for the old type resistor look.

Date: Sat, 4 Jan 2003 19:33:50 -0800 (PST)
From: Joe Foley <redmenaced@yahoo.com>
Subject: Re: [R-390] IF deck caps

Nah, he's talking about the yellow plastic ones in the '67 EAC's, they're good caps, as caps go, just don't get too close with the soldering iron!

From: "Jerry Kincade" <w5kp@direcway.com>
Subject: Re: [R-390] IF deck caps
Date: Sun, 5 Jan 2003 00:09:23 -0600

The decision is made, the original yellow jacket Aerovox's stay in. Thanks for all the friendly advice. Now on to the audio deck, and trying to find a 560 ohm 2W carbon Rippel resistor!

From: "Bill Smith" <billsmith@ispwest.com>

Subject: Re: [R-390] IF deck caps
Date: Sat, 4 Jan 2003 22:54:20 -0800

This is true of electrolytics, but not of paper caps. The latter may initially operate ok in a set that has been on the shelf for a long time, but will begin to leak badly in only a few hours of operation. You can hear a set "tighten up" if you place a set with bad caps in operation.

Whistles will appear, audio becomes distorted, AVC doesn't work, and the AF gain control has to be turned up well beyond the first 20 or so degrees where it usually operates. I have found a simple test with a VOM works well. Disconnect on end of a suspect cap, and measure the resistance with the highest ohms scale.

If any residual resistance shows on the scale, the cap is leaky. Disconnect the probe, then reattach. If the cap shows a "kick" on the meter each time the probe is attached, it can't hold the charge of the vom battery, and is leaky. Many, but not all, electrolytics will self-heal, if allowed to reform as described above. Not so with papers, they will just get worse. They also have a tendency to open or exhibit a poor power-factor over time.

Date: Mon, 06 Jan 2003 17:59:51 -0500
From: Jim Brannigan <jbrannig@optonline.net>
Subject: [R-390] Caps?

I may need to replace some of the .05 1000V disc ceramics. The cupboard is bare and could not find them at Mouser, Allied or Antique Radio. Any sources?

From: "Scott, Barry (Clyde B)" <cbscott@ingr.com>
Subject: RE: [R-390] Caps?
Date: Mon, 6 Jan 2003 17:08:11 -0600

Aren't these what you want?
<http://www.mouser.com/index.cfm?handler=fra_pdfset&pdffile=296>

Date: Mon, 06 Jan 2003 18:19:02 -0500
From: Kim Herron <kherron@voyager.net>
Subject: Re: [R-390] Caps?

Mouser Electronics. Latest Catalog, Page 296 Part number 75-10HKS50, @ $1.48 ea in single lot.

Date: Mon, 06 Jan 2003 18:27:27 -0500
From: Barry Hauser <barry@hausernet.com>

Subject: Re: [R-390] Caps?

Hi Jim et. al. Try http://www.justradios.com/orderform.html
Scroll down and look at the right side. Has .047 @ 1600V $0.99 US.

Date: Mon, 06 Jan 2003 22:50:22 -0500
From: Jim Brannigan <jbrannig@optonline.net>
Subject: Re: [R-390] Caps?

Yup, Thank you. I checked on-line and in a catalogue. The closest I could find was .01 @ 1KV I did not look hard enuf..... and thanks to all the others.....I am "making a list" for Mouser, so will add these to it and keep the other sources on file.

From: "Drew Papanek" <drewmaster813@hotmail.com>
Date: Tue, 07 Jan 2003 13:37:00 -0500
Subject: [R-390] Re: (testing capacitors)

<snipped> I have found a simple test with a VOM works well. .....

That test will often work, but sometimes capacitors do not show appreciable leakage (or breakdown) unless tested at higher voltage. A more sensitive test is to use your VTVM or DVM set to the volts scale, in series with cap under test and a power supply of appropriate voltage (preferably the cap's rated voltage). The meter serves as a sensitive microammeter with a built-in current limiting resistance. To calculate a cap's leakage tested in this way, divide meter reading by meter's input resistance (typically 11 meg).

A typical BBOD might show 100v reading with a 300v power supply. This works out to 9 uA leakage (with 200v across cap), and this cap would be removed post haste and sold on E-Pay to the highest bidding audiophool. If you want to get really picky, adjust the supply voltage so that the difference between it and the metereading equals cap's rated voltage. Heat the capacitor slightly (hairdryer) and watch leakage go through the roof! Shows what happens as the radio gets hot.

Modern plastic dielectric caps such as the higly esteemed Orange Drop will show no discernible reading, just a fluctuation of a few tenths of a volt positive and negative (power supply noise).

From: "Drew Papanek" <drewmaster813@hotmail.com>
Date: Fri, 17 Jan 2003 16:30:42 -0500
Subject: [R-390] Lead Lengths (was Resistors, SSB)

..... had some places where I could solder in a terminal strip .....

That method works well too. When replacing caps in applications where they are already on terminal strips/standoffs, a reverse of this method can be used. On an R-390A IF deck I have put replacement caps right on tube socket pins when originals were standoff-mounted. The smaller size of modern caps makes this possible. A note about relocation can be written on chassis under original cap location. This method gives shorter lead lengths and often eliminates need for insulating sleeving (but will not appeal to purists).

Date: Mon, 17 Feb 2003 10:27:52 -0600
From: windy10605@juno.com
Subject: [R-390] Some thoughts on capacitor leakage

Continuing on with my R-390 project..... Time to decide which mica caps are to be replaced. Many of them "fail" at 500V in the "mica" cap position on the Heathkit IT-28 cap checker where the eye closes at roughly 0.1uA for the "paper/mica" cap position and is a little on the sensitive side (an Eico cap checker I had, closed at 1.5uA). So here is a better way: after determining the voltage settings on the cap checker are "close", insert a digital uA meter in series with the leads and read the real leakage at the WV. The C327 mica (Chuck Rippel says it's a problem capacitor) read 2.5uA ....clearly a bad mica. Most of the mica capacitors which closed or started to close the eye on the IT-28, really read 0.1uA or less at 500V ...perfectly good. 73 Kees K5BCQ

Date: Mon, 17 Feb 2003 11:28:57 -0600
Subject: Fw: [R-390] Some thoughts on capacitor leakage
From: windy10605@juno.com

The only other bad mica on the RF deck (with a relatively high 4.0uA leakage) is C286 ...also an "El Menco" 100pf mica like C327 ...mmmm, I see a trend developing, maybe. Mfg part # CM15F101GN3. 73 Kees K5BCQ

Date: Mon, 17 Feb 2003 11:32:16 -0600
Subject: Fw: Fw: [R-390] Some thoughts on capacitor leakage
From: windy10605@juno.com

Meant R-390A, not R-390

From: ToddRoberts2001@aol.com
Date: Mon, 17 Feb 2003 13:00:54 EST
Subject: Re: Fw: [R-390] Some thoughts on capacitor leakage

I have found leaky silver-mica capacitors inside various RF Deck transformers over the years also. They caused the sensitivity to go down

on certain RF bands. Other people have determined that over the years the silver tends to "migrate" across the mica insulation causing the older style moulded silver-mica caps to become leaky and intermittent over the years. Good idea to stock up on various sizes of new manufacture epoxy-coated 500V silver micas to keep on hand for future repairs. Mouser Electronics has a good selection.

From: "Kenneth Crips" <w7itc@hotmail.com>
Date: Sun, 16 Mar 2003 21:12:41 -0700
Subject: [R-390] Black beauties

I have a question about the so called black beauty, red stripes, etc. As I understand it these where made by Sprague. I have a bunch of these capacitors that are brand new unused. Do these things deteriorate while in use over time, or by age regardless. I would love to use them but if they are always bad I suppose it's a waste of time.

Date: Sun, 16 Mar 2003 23:33:15 -0500
From: Glenn Little WB4UIV <glennmaillist@bellsouth.net>
Subject: Re: [R-390] Black beauties

I think that the black beauty caps are all bad by definition. Check some of your NOS pieces on a good capacitance meter and report back on the leakage at rated voltage and the capacitance. It would be good to know.

From: "Kenneth Crips" <w7itc@hotmail.com>
Subject: Re: [R-390] Black beauties
Date: Sun, 16 Mar 2003

I have a Cap tester on this ExTech multimeter I just purchased. It seems to be accurate. The problem I have is just how reliable is the meter checking.

From: "Kenneth G. Gordon" <keng@moscow.com>
Date: Sun, 16 Mar 2003 22:30:40 -0800
Subject: Re: [R-390] Black beauties

Multi-meter cap testers don't have high enough voltage to really check leakage in caps. They can do a decent job of measuring capacitance only. You would need a Sprague Tel-Ohm-Mike, or Heathkit C-3 or IP-28 , or equivalent, type of capacitor checker to measure leakage. You have to check the caps at their rated voltage in order to get an accurate idea of leakage. One way you can check them for leakage without the above listed capacitor checker is to connect them in series with a decent milliameter across a source of HV at the rated voltage of your capacitor. If the milliameter reads much above a microamp or two, the capacitor is leaky.

From: "Kenneth Crips" <w7itc@hotmail.com>
Subject: Re: [R-390] Black beauties
Date: Mon, 17 Mar 2003

With Orange Drops so cheap there is no reason to use such old junk. I'll hang on to them for now. Should I say on E-Bay they where touched by Mr. Macintosh himself, or in the presents of an Western Electric 300.

Date: Mon, 17 Mar 2003 09:50:32 -0500
From: Roy Morgan <roy.morgan@nist.gov>
Subject: Re: [R-390] Black beauties

>I have a question about the so called black beauty,.....

There is good news and bad news. The bad news is that all of them are leaky. New, unused, pristine, it does not matter. Chemistry did it. It's not your fault. It's not Sprague's fault. They will not work well. The good news it that you can sell them on eBay for money. Real money. Just do it. Then buy new good last forever nice working capacitors from wherever you can. It does not matter what kind you buy. Jut do it. They will make your radio happy.

From: "Drew Papanek" <drewmaster813@hotmail.com>
Date: Mon, 17 Mar 2003 12:25:18 -0500
Subject: [R-390] Black Beauties

Yes, these Black Beauties are bad by definition. I have a few NOS Black Beauties of Death and they test leaky. Leakage testing using a milliammeter in series with a high voltage power supply will certainly work, but a milliammeter is not sensitive enough to detect leakage current levels which would be detrimental in vacuum tube circuits. If the capacitor under test has extremely high leakage or shorts out, destruction of the milliammeter is certain. A more sensitive and robust test is to use your VTVM or DVM set to the volts scale, in series with cap under test and a power supply of appropriate voltage (preferably the cap's rated voltage). The meter serves as a sensitive microammeter with a built-in current limiting resistance. To calculate a cap's leakage tested in this way, divide meter reading by meter's input resistance (typically 11 meg). A typical BBOD might show 100v reading with a 300v power supply. This works out to 9 uA leakage (with 200v across cap). If you want to get really picky, adjust the supply voltage so that the difference between it and the metereading equals cap's rated voltage. Heat the capacitor slightly (hairdryer) and watch leakage current soar. Shows what happens as the radio gets hot. Modern plastic dielectric caps such as the higly esteemed Orange Drop will show no discernible reading, just a fluctuation of a few tenths of a volt positive and negative (power supply noise). Believe it or

not, I have read banter in some of the AudioPhool forums extolling the "sonic virtues" of NOS Black Beauties and Vitamin Q's. You might sell your BBOD's on one of those forums or on E-Pay and make a bundle!

From: "G4GJL" <G4GJL@btopenworld.com>
Subject: Re: [R-390] Black beauties and other old capacitors
Date: Mon, 17 Mar 2003 19:43:40 -0000

I would advocate the use of the Vishay Roederstein MKT1813 range of capacitors when replacing the likes of BBODs and others in the range 4700pF to 1uF at 400 or 630 v working. These are available in the UK, Europe and yes...the USA! Their advantage, in my opinion, over the now famous Orange Drops is that they are of axial construction (Cylindrical with the leads emerging from the centre of the two ends.) They are much easier to fit as replacements for the old axially constructed BBODs, Vitamin Qs etc as the leads are in the right place with respect to the capacitor body...you dont need to cram them in as often they are smaller than the capacitor you are replacing. Outer foil is clearly marked with a ring. The capacitor is made of Yellow polyester and is much more in keepink with the colours of the era of our R39/- series friends. ...And on the subject of DC leakage they pass the VTVM and HT PSU test in the same manner as the Orange Drops...With flying colours! They perform well as coupling / decoupling capacitors at DC, AF, well into the RF spectrum. I would NOT use them as a resonating capacitor, though.

From: "Al Parker" <anchor@ec.rr.com>
Subject: Re: [R-390] Black beauties and other old capacitors
Date: Mon, 17 Mar 2003 15:13:33 -0500

I'm ready to order a qty of 0.01's, so took a look at Mouser for the MKT1813 polyesters. They do list them as a new product, but only have some values in stock, no 0.01's, 0.022@250v, all the rest are 0.1 and above, a few at 630v. The price is slightly above their Orange Drop polypropylenes, which they do have in 0.01@630vdc, in stock. (400v is not very useful, I think.) Newark, whose online catalog is horrible to navigate, has even fewer in stock. I guess I'll have to wait until next order, even tho' I agree with the advantages you point out. thanks for the tip, Al

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Date: Tue, 18 Mar 2003 08:14:40 -0600
Subject: Re: [R-390] Black beauties
From: blw <ba.williams@charter.net>

> With Orange Drops so cheap there is no reason to use such old junk.....

Yes, say they came out of a McIntosh and were shaped properly. You have

that
special CD to run all of the right frequencies so they form just right. You should make some good money this way.

From: "Drew Papanek" <drewmaster813@hotmail.com>
Date: Tue, 18 Mar 2003 13:07:15 -0500
Subject: [R-390] Black Beauty Replacements

>I would advocate the use of the Vishay Roederstein MKT1813
<snipped>

Excellent choice, these are very good capacitors. Another good choice is the Cornell-Dubilier (CDE) DME series, available inexpensively in a wide range of values from Mouser. These caps are so small that despite their radial lead construction you can fit them in easily. In the R-390A IF deck many of the BBOD's are installed on standoffs with a couple of inches total lead length to tube socket pin. DME's can be installed right on the tube socket with much shorter lead length (possibly a benefit in bypass application). A "relocation notice" can be written in the original BBOD location. Yes, DME's also show virtually no leakage at rated voltage. Like the MKT1813's, DME's are not well suited to high current applications but are fine for bypass, coupling, timing and the like. The Orange Drop is a fine capacitor with a proven reputation for reliability going back over 40 years. They were originally manufactured by Sprague. Maybe Sprague came up with such a good product as attonement for their BBOD's.

Date: Tue, 18 Mar 2003 13:08:46 -0500
From: tbigelow@pop.state.vt.us (Todd Bigelow - PS)
Subject: Re: [R-390] Black beauties

> I have a question about the so called black beauty, red stripes, etc.
> As I understand it these where made by Sprague < snip>

I've read the responses to this and decided to add my 2¢ worth. My experience and understanding from other more knowledgeable than me is no, not all caps classified as 'Black Beauties' are bad, meaning of questionable design. Contrary to popular belief, there were several types and not just one. Some were black with red writing, some were black with yellow writing, some had a number of colored bands on them and so on. Having seen them in many applications over the years I've seen fewer of the obvious split and leaking than still intact examples. Not being an expert I won't try to tell you which ones are the types that almost always go bad because I don't remember. Instead my advice would be to at least test them and not dismiss them out-of-hand based on popular opinion. Having said that, I'd also point out that even as NOS caps, they are probably 35+ years old at the very least. I'm not sure I'd want to install

them into anything critical even if they check out okay. Might end up costing a lot.

SBE Orange Drops are indeed inexpensive, they come in different types(not just one composition), and the company is located here in the USofA, not China. Recently a friend who works there told me that the vintage radio and guitar/audio crowd has pretty much been carrying the business through the slow time. Roy had the best suggestion: sell 'em on epay. Consider that you're doing a service to some audiophile type by providing them with an original component not easily found these days. I saw someone post here once that this is 'wreckless and dangerous' or something to that effect, not sure why. Perhaps it was based on that general 'all of them are bad' statement.

Regardless, where would we be if people refused to sell tubes to use because they could break and cut someone or because they use more energy than an IC chip? Or that old adage about "one man's trash.." Someone sold a handful of them a few months ago for over $200. Doesn't take too many of those to make an R-390!

From: "Drew Papanek" <drewmaster813@hotmail.com>
Date: Mon, 21 Apr 2003 14:20:13 -0400
Subject: [R-390] Capacitors (was New Owner...)

>Mikea wrote: It is possible -- even probable -- that the power supply filter caps, and
>many other caps in the radio, are leaky and/or out of tolerance. The
>filter caps can be re-formed: bring the rig up _slowly_ on a Variac,
>starting off at something like 50VAC input.

Paper and electrolytic capacitors are very common failure items in old electronic equipment. Many recommend wholesale replacement of these capacitors. Modern plastic dielectric caps (orange drop, et al.) used as replacement for paper work very well and will likely outlast most of us.A better but more effort consuming method of reforming electrolyticapacitors is connection of cap to be reformed to a DC source of at least rated voltage with current limiting resistance of about 100K. Voltage across cap can be monitored with high impedance meter (VTVM or DVM) as it slowly rises over minutes or hours. A few hundred microamps (voltage across current limiting resistance divided by resistance) or less at cap's rated voltage denotes success. Beware of R-390A electrolytics made by General Instrument. These will frequently fail even after reforming. Cleaning corrosive guts of exploded electrolytics from inside radios is a royal pain in the scrot.Ceramic disc capacitors seldom fail even after many years use.Much information about all of these topics and more can be found in Wei Li's compilation of

postings over the years from this list. Goto r-390a.net Click on "References", "Pearls of Wisdom".

From: DAVEINBHAM@aol.com
Date: Thu, 15 May 2003 15:45:42 EDT
To: r-390@mailman.qth.net
Subject: [R-390] The Last of the ReCap kits

I know I promised y'all several months ago I would put the rest of the ReCap kits on EPAY, but due to circumstances beyond my control (broke my foot in January, wife back in hospital for more cancer treatments in Feb & March, I had a cancer cut out last week) it did not happen. I have 3 in-the-can kits and 7 under-the-chassis ReCap kits left. And when they are gone, they are gone forever.

From: "Phil Atchley" <k06bb@elite.net>
Date: Thu, 26 Jun 2003 18:39:02 -0000
Subject: [R-390] Relative reliability of various capacitors? BFO Question.

Hi. Today I took a "peek" under the IF deck (EAC S/N 9653) to see what evil critters might be lurking in there. A couple pleasant surprises. FIRST, there are only TWO BBoD's (brown beauties of death) lurking in the IF amplifier. "Most" of the other capacitors are yellow Aerovox units with a scattering of West-Cap metal/glass capacitors. The FIRST thing I did was replace the mechanical filter coupling capacitor (West-Cap) with a 630VDC jobbie and will naturally replace the two BBoD's.

Question: What is the relative reliability of the Yellow Aerovox units as well as the remaining West-Cap Metal/glass jobs? I DID notice most of the Aerovox caps are rated 200 Volts where I tend to use 630 Volt capacitors where they fit.

If the rest of the receiver follows this pattern it may not be a terribly tough job to overhaul. I did notice that the IF amplifier appears to be VIRGIN underneath the chassis!

NOTE: The BFO in this unit is a unit made by some company called F & W Inc.
Anybody ever heard of them?

From: "Walter Wilson" <wewilson@knology.net>
Subject: Re: [R-390] C551
Date: Tue, 8 Jul 2003 21:32:51 -0400

I have found a nice poly cap, 2.2 uF, 630V rated (Mouser part number 5989-630V2.2), that can be squeezed inside the existing can that held

C551. It's a real pain to cut and clean out the old C551 can, so some just solder the new ones underneath the IF deck.

How do you know that C551 is not up to par? On a local (steady) AM station, does the carrier meter reading change between the slow, med, and fast AGC positions? If so, I'd agree that C551 is leaking enough to affect performance. If the carrier meter reading is the same at all AGC positions, your problem might not be C551, but rather somewhere else in the AGC circuit.

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from the collins list:

From: "jfuhrman" <jfuhrman@kc.rr.com>
Subject: Re: [Collins] 75A4 sensitivity
Date: Tue, 8 Jul 2003 14:55:02 -0500

I had a similar problem with my 75A4. But, first back to the beginning. I found several caps that should be on the list. The following describes my initial replacements:

12/11/2002 75A-4 Replacements / Mods / Changes

During the previous decade many 75A-4 receivers were brought back to life by CCA/CRA members. During this time various capacitors were noted and recognized for their likelihood of being defective or a source of problems. Some of the various capacitors were also recognized for their danger to life due to the PCBs used in their manufacture. These caps are often referred to as the "deadly capacitors" They are typically called "Black Beauties" for their color but many manufacturers have used a variety of different colors of plastic. Light green, pink and light tan come to mind. PCB is the acronym for Polychlorinated Biphenyls. PCBs have been demonstrated to cause a variety of adverse health effects. PCBs have been shown to cause cancer in animals. PCBs have also been shown to cause a number of serious non-cancer health effects in animals, including effects on the immune system, reproductive system, nervous system, endocrine system and other health effects. Studies in humans provide supportive evidence for potential carcinogenic and non-carcinogenic effects of PCBs. The different health effects of PCBs may be interrelated, as alterations in one system may have significant implications for the other systems of the body. Detailed information is available on the EPA website. Since the PCB danger is real and proven, all capacitors suspected of containing PCBs should be carefully removed and replaced, regardless of the brand of equipment. Orange Drop Mylar & foil capacitors have received a great deal of coverage. While they are a quality capacitor, there are several metallized polyester (mylar) film caps that have non-inductive characteristics with smaller size and lower costs.<snip>

From: "Forrest Myers" <femyers@attglobal.net>
Subject: Re: [R-390] C551
Date: Wed, 9 Jul 2003 09:05:09 -0400

Walter, The carrier meter reads lower on the slow AGC setting. The audio is also distorted on strong stations while in the slow AGC position. On medium or fast settings, the carrier meter reads higher and the audio is never distorted, no matter how strong the signal gets. Reading, somewhere on the web, I seem to remember that this could be caused by a leaky C551. Does that sound reasonable?

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from the Collins list

Date: Wed, 16 Jul 2003 17:12:29 -0500
From: "Dr. Gerald N. Johnson, electrical engineer" <geraldj@isunet.net>
Subject: Re: [Collins] 75A4 sensitivity *(capacitor comments)*

I don't think the molded oiled paper capacitors used in 50s vintage receivers used PCB. I think they used plain kraft paper and mineral oil. I've NOT detected the characteristic odor of the particular PCB used in capacitors (and transformers) around those capacitors even when the case is split. While certain abuses of PCBs have caused increases in cancers, particularly by ingesting the PCBs, its a wonder that the electrical industry making capacitors and transformers using Askeral or Pyranol and other brands of electrical insulating PCBs have never been charged with causing excess cancers in their employees that handled very large quantities of PCBs. Those companies have been charged with dumping stray PCB into the rivers outside their plants so that the river beds and water creatures do contain considerable PCB. Pyranol is more common in metal cased capacitors, sometimes used in radios. Pyranol and the other brands of electrical insulating PCB (there are four chemical compounds called PCB, only one used for insulating oil) have a distinctive odor. Pure mineral oil has no odor. Its against the law to dispose of such capacitors in the common trash, they must be incinerated at designated facilities. I don't know how to find those places. I like Orange Drops because I've abused them beyond reason without change in leakage. I've not tested other brands that way. And in the past times there have been very compact mylar capacitors from the Pacific rim with marginal insulation thickness and less than marginal lead wire sizes.

The original capacitors generally did not have non-inductive characteristics. In some cases the inductance and capacitance were chosen to be series resonant, often at 455 or 500 kHz. Orange Drops weren't made with extended foil 30 or 40 years ago, but they are now which cuts their inductance a great deal. <snip>

From: <wb5tcd@sbcglobal.net>
Date: Thu, 14 Aug 2003 20:51:53 -0500
Subject: [R-390] c609 replacement

I need to replace this capacitor. Should it be the same tantalum type?
Why is this type used for this circuit is there something critical about it?
Wayne

From: "Glen Galati" <eldim@worldnet.att.net>
Subject: Re: [R-390] c609 replacement
Date: Fri, 15 Aug 2003 00:24:55 -0700

I would continue to use Tantalum as it is known for it's high stability, large capacitance and small size. I don't have a schematic to view the application, or part number. Any other particulars, such as Value, Voltage, Part Number, Stock number, and I'll see if I have one in stock.

Date: Fri, 15 Aug 2003 10:46:49 -0400
From: Roy Morgan <roy.morgan@nist.gov>
Subject: Re: [R-390] c609 replacement

> I need to replace this capacitor. Should it be the same tantalum type?

Not necessarily. It serves as the cathode bypass cap in the audio preamp stage. Modern electrolytic caps will be both smaller and longer lasting. The actual voltage on the cap is far below the rating of the original cap, being the self-bias voltage developed by the cathode current in the cathode resistor..Something on the order of a few volts (do check the tube voltage charts/diagrams to see what the normal voltage is.) I recommend you find whatever small cap you can that fits physically and has a capacitance value greater than the original and any DC rating above 5 volts. The bass response of the receiver may be extended to a lower frequency.. I doubt that you will mind that

>Why is this type used for this circuit is there something critical about it?

The only thing critical about it is that it be small enough to not get mashed when you put the module back in the radio.. You can mount the replacement UNDER the circuit board if you have only a cap which is physically too large. Go to rat shack with two bucks and solve your problem.

From: "Philip Atchley" <k06bb@elite.net>
Subject: [R-390] c609 replacement
Date: Fri, 15 Aug 2003 15:11:55 -0000

I Used a new 47uF 35 VDC 'lytic in my receiver restoration. Works fine and as noted below the audio seems "fuller", but then I did the C. Ripple audio mod, replacing the two specified .01uF caps with .033uF.

From: "Drew Papanek" <drewmaster813@hotmail.com>
Date: Fri, 15 Aug 2003 11:44:50 -0400
Subject: [R-390] C609 replacement

C609 is the cathode bypass cap for the first audio amplifier stage. That is not a critical circuit. I believe tantalum was used to achieve performance over the entire military temperature range. In the sheltered lives that most of our
R-390(*) lead, aluminum electrolytic would be more than adequate. For a few dimes more you can use a tantalum part. The 35v rating is not necessary; even with the tube shorted plate to cathode C609 would not see more than about 6v.

From: "Barry Hauser" <barry@hausernet.com>
Subject: Re: [R-390] c609 replacement
Date: Fri, 15 Aug 2003 15:28:21 -0400

That's the Alien-Acid-Bleeder in the AF deck, right? Apparently it's not critical. I've been using the 10 mfd 35v electrolytics from Radio Shack. Their catalog number is 272-1013 -- 99 cents. It's an axial lead cap that fits easily on the board. They also have a 10 mfd 16vdc dipped tantalum for $1.49. This is a lower voltage rating, but as Drew pointed out that the actual voltage the cap sees is something like 6 volts. I don't know that the tantalum-ness buys you anything and the dipped/radial form-factor isn't particularly helpful. Of course, you can use non-Radio Shack parts, and you may well have a suitable electrolytic in your parts pile. I just get a (small) kick that there's still _something_ in that store that can be used in an R-390A. The list is shrinking.

Date: Wed, 3 Sep 2003 17:20:58 -0700 (PDT)
From: David Medley <davidmed82@yahoo.com>
Subject: [r-390] Critical Issue

I am presently working on an R-391, a very old one. The audio deck was original without mods. The following is an exerpt of a message I just sent the owner. Anyone who owns an R-390 or R-391 should check this out. This damage can be horrific.

"The radio is disassembled completely. I have finished overhauling the audio/VR deck which is the most time consuming part. This one is very old and did not have any of the later mods. I have brought it up to date

and replaced all critical parts. One of the bad things with these early assemblies is the 8uf cap in the audio section. This thing leaks acid over time and I have seen cases where complete replacement of the circuit board was needed and extensive cleanup of the chassis as well. If you have any other R-390/391 radios you should check this out. The mod is simple and eliminates this cap. In this one the cap had not started
to leak so no damage was done."

Please note this applies to R-390/391 radios although I believe there may be a similar problem with early R-390A radios.

From: "Barry Hauser" <barry@hausernet.com>
Subject: Re: [r-390] Critical Issue
Date: Wed, 3 Sep 2003 21:43:26 -0400

I didn't realize that the non-A and '391 also have this cap, or do they? Is it the same type of small axial metal tantalum that's on the component board in the
R-390A audio module? I finally found one out of about 12 that didn't toss it's cookies. But usually the damage is limited to a 3/4 inch round splotch on the board and the two components alongside it. The 8uf tantalum (C609) is fairly small and doesn't have enough acid to do much more than burn a small crater in the board. A good photo is on Chuck Rippel's site

http://www.r390a.com/ProbCaps.html

Scroll about halfway down to see C609. Some vary in style a bit, but they're all about the same size. They usually don't look as neat as the one in Chuck's photo.

From: "Don Reaves W5OR" <w5or@comcast.net>
Subject: RE: [r-390] Critical Issue
Date: Wed, 3 Sep 2003 21:33:29 -0500

C609. You mean this one?
http://www.militaryradio.com/Images/caprotpcb3.JPG

If anyone needs a replacement I have a lifetime supply of 10uf/50V electrolytics. They are radial mount but by judicious bending of the leads they fit nicely. Drop me a note if you want a couple. (free to listmembers)

From: "Barry Hauser" <barry@hausernet.com>
Subject: Re: [r-390] Critical Issue
Date: Wed, 3 Sep 2003 22:43:54 -0400

Yeah -- that's the other style - sort of a bullet. As with most, wasn't "house-trained".

Date: Thu, 4 Sep 2003 14:07:23 -0700 (PDT)
From: David Medley <davidmed82@yahoo.com>
Subject: Re: [r-390] Critical Issue

I was discussing the cap in the R-390/391. This is/was a tantalum disaster that contained a surprising amount of acid. This together with the considerable heat in the R390 can cause a surprising amount of damage. The cap in the R-390A is a more modern variety I think. Collins modified the circuitry of the R-390 quite early on to eliminate this cap altogether. Dave

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Date: Sat, 01 Nov 2003 11:46:20 -0500
From: K2CBY@aol.com
Subject: [R-390] Capacitor Heresy

It has long been an article of faith that you begin to rehab an R-390/R-390A by yanking out all the paper capacitors -- particularly the notorious "Brown Buggers" -- and replacing them with Orange Drops.

I recently went through this process with an R-390A Teledyne IF subchassis (Contract No. 3785C-PC-63, Serial No. 6369), and the results were surprising. After about four hours of squinting, sweating and cussing I managed to excise all of the original capacitors and replace them with modern polyester and polypropylene types of equivalent capacitance and voltage rating (more on this later). Removing the BFO to access the capacitors connected to points beneath the tuning shaft was a particular nightmare because some clever techie (or maybe the factory) has Lock-tite-ed the set screws on the bellows coupling. I persevered and managed to finish the job without singing the wiring harness more than a couple of times (love that smell of scorched plastic) and a minimum of other collateral damage. I then tested the IF strip in the receiver and noted no real change in performance in terms of either gain or noise figure. This left me with a pile of 19 old capacitors on the bench. As I was about to sweep them into the trash bucket I started to wonder "Just how bad are these things?" so I started a little investigation. They all looked OK mechanically. There were no cracked cases, oozing gunk or peculiar bulges. Nothing smelled out of the ordinary.

Although I hadn't paid too much attention to it when I pulled the capacitors, I noted that there were two distinct types. Teledyne (and probably all the other contractors) used the brown Bakelite cased tubular units only as bypass capacitors -- B plus line, cathode to ground, or screen to ground. The plate to grid coupling capacitors were all metal cased with plastic or epoxy seals â€“ the type Sprague used to call "Vitamin Q," although the ones in this unit were by Astron and General Instrument.

I started out by measuring the capacitors on an ESI capacitance bridge at a 1 kHz test frequency. Every last capacitor measured within 8% of rated value. Since the spec on many of these was only 20%, I thought this was pretty impressive. I then measured the dissipation factors. These ranged from a worst case of .013 for the brown tubulars to less than 0.01 for all the metal-cased units. For the 0.1 µF capacitors, the computed series resistance was < 21 ohms in all cases; and for the 0.033 µF capacitors the series resistance was less than 68 ohms. In all instances, the metal cased units had less than half the series resistance of the brown tubulars.

I then measured the insulation (shunt) resistance of the capacitors on a ZM-11 bridge. For the 0.1 µF "Brown Buggers" the values ranged from 60 Meg to 75 Meg; and for the brown 0.033 µF units, 800 Meg to 2,800 Meg. The metal-cased capacitors ranged from 8,400 Meg to 10,000 Meg (the limit of measurement). It should be noted that these measurements were taken with applied voltages (up to 500) substantially higher than the rated working voltages of the capacitors.

By way of comparison, new out of the box Orange Drops had a measured D of .004 and an insulation resistance in excess of 10,000 Meg (limit of measurement) for both the 0.1 ÂµF and the 0.033 ÂµF units.

I drew three conclusions from these tests. First, the Collins engineers were no dopes. They confined the brown tubular capacitors to non-critical applications and used premium-grade, metal-cased units where leakage resistance and dissipation factor really made a difference. Second, the original capacitors aged remarkably well. There wasn't one of them in my IF strip that actually needed replacement. Third, unless you are a glutton for punishment or just love to see the orange sparkle of fresh capacitors glinting from inside the radio, it probably doesn't pay to re-cap unless the receiver is showing symptoms of distress.

The B plus and screen bypass capacitors are most likely to fail, and if they start to leak the plate and screen voltages will be noticeably low. The interstage coupling capacitors are pretty safe because they are higher quality. If they commence to leak, the failure will be obvious because the grid of the following stage will be driven into conduction, resulting in zero or positive grid voltage and vastly excessive plate current. The cathode bypass capacitors are least likely to fail since they operate at a tiny fraction of their rated voltage.

The only exception is the infamous C-552 (0.01 µF 300 dcwv) that couples the plate of V501 to the mechanical filters. Because its failure will fry the filters, it should ALWAYS be replaced with a top quality new part with a voltage rating of at least 350. It's also easy to reach, and there is plenty of room to fit a replacement.

I have a couple of additional observations.

Capacitors come in small packages these days, and by 21st Century standards Orange Drops are pretty bulky. I instead used CDE Sub Miniature Metallized Polyester DME Types, which are about 1/4 the volume of an Orange Drop. The types are DME2P1K 0.1 µF 250 volts (Mouser part no 5989-250V.1); DME 4S33K 0.033 µF 400 volts (Mouser 5989-400V.033) and DME 6S1K 0.01 µF 600 v (Mouser 5989-600V.01) for C552. Although the capacitors looked pretty good in my IF subchassis, the resistors were another story. I measured each of them, and almost half were more than 15% out of tolerance. Invariably, the resistance was higher than it was supposed to be in a couple of cases, about 25% high. I also found a couple that were charred but amazingly enough one of these still on value. I left the grid resistors and AGC bus resistors pretty much alone since those values are non-critical but changed all the others that were more than 10% off.

In conclusion, maybe it pays to keep a closer eye on resistors than to routinely replace all capacitors.

From: "JamesMiller" <jmiller1706@cfl.rr.com>
Subject: Re: [R-390] Capacitor Heresy
Date: Sat, 1 Nov 2003 13:48:09 -0500

If the caps. were all pretty good, I wonder what it was that improved the performance of the IF strip? My experience has been likewise in the IF strip. Here's a story from the RF deck. I had questionable performance on all bands, intermittent, heat-related. I had already replaced the .033 capacitor on the rear wafer of the bandswitch. I decided to go through the whole deck and replace ALL of the ,005 disc capacitors. I then checked the tightness of all chassis screws holding ground lugs or tube sockets... yes some were a little loose,... Additionally, I sprayed the tube sockets top and bottom with "Big Bath", which is an oil and moisture displacement spray. Oil seeps down from the gears to the chassis and eventualley leeches into the porous material that the tube sockets are formed from... enough of an impedance change results to affect performance a little. After all this, Wow, what a difference in performance now! It is really "hot" on all bands. Most of the ,005 discs are used for screen and B+ bypass, a few are used to filter the filaments (I didn't replace all of the filament caps.). I did not measure the old ones.

Another thing I discovered in this radio... on one band (the upper AM broadcast band) the carrier meter would change about 10-20 dB for no apparent reason, usually a function of how long the radio had been on. It would play solid 60 dB on the local station for 30-45 minutes, then

suddenly drop 10-20 dB. It was a local station and this was not due to propagation changes. After much head scratching and deduction, this was finally traced to an intermittent failure in a capacitor in one of the band coils. It was in coil Z202-1, a 2400 pf cap (C-235-1)inside the coil can ... one end of this cap "touches" the B+ line feeding the V201 RF Amp via the coil in Z202. The other end of this cap. is in series with a 180 pf cap, both across the coil. My suspicion is that the radio was used a lot by the previous owner on the broadcast band, hence this cap. was subjected to B+ longer than any others, and developed a failure. Alternately, the higher value combined with aging resulted in a voltage breakdown of some kind. The failure didn't change the resonance of the coil greatly, but enough to reduce the signal coupled to the next stage. I bought a new can and it works well now. I suspect that any questionable performance on other specific bands could be traced to similarly failed capacitors in the coil cans for those bands (C232-1, C234-1, C238-1, etc). The moral is don't forget internal failures in these cans when diagnosing problems. (PS I got the replacement can from Fair Radio)...

From: "Scott Seickel" <polaraligned@earthlink.net>
Subject: Re: [R-390] Capacitor Heresy
Date: Sat, 1 Nov 2003 19:30:54 -0500

I restored a Teledyne unit about 1-1/2 yrs ago. Came to me in nice condition with all Teledyne modules and original meters. Well kept. I recapped the whole unit and tested all removed capacitors on a Sencore LC75 analyzer. I found about 2/3 of them to have had significant leakage. Several of the "Brown" caps also had cracks. I would not second guess recapping this set again. My experience with the resistors in my set was similar to yours.

From: "Bill Smith" <billsmith@ispwest.com>
Subject: Re: [R-390] Capacitor Heresy
Date: Sun, 2 Nov 2003 16:40:28 -0800

I did need to replace several mica capacitors in R-390 RF cans which had either opened or developed leagage, or both. Many were of very small capacitance values, in the range of 10-300pf. Several resistors in the power supply failed, and others in the IF strip have likely been stressed by the power supply's failure, but values have not risen enough to warrant replacement, yet.

The R-390 unit here was built with Vitamin Q capacitors and none of them have failed. That isn't the rule for capacitors, however, it is the exception. Although Vitamin-Q types (hermetically sealed, metal case devices) have held up superbly, it is my experience that virtually all other types fifty years and older have developed leakage.

For example, WWII oil-filled bathtub types which have thought to be indestructable are now commonly found with excessive leakage. Square micas made of a pink moulded composite case are notorious. Many other old mica capacitors are open and/or leaky also.

Exceptions can be found. I have a Hallicrafers S-38B with original capacitors which plays fine. The electrolytics in those sets are a story in and of themselves (they are still working fine). But as a rule, all paper caps and 10% of resistors can be assumed to be need of replacement in virtually all equipment built before the 1960's.

Unfortunately, several sets which hadn't been used for many years apparently worked well for the first several hours but could be observed to "tighten up" and begin to distort signals with use.

From: "Ronnie Davis" <rdavis24@carolina.rr.com>
Date: Fri, 12 Dec 2003 17:03:59 -0500
Subject: [R-390] Capehart update

Hello again Just got back in the house after pulling the AF deck out and recapping it with one of Walter Wilson's kits. Was not quite as bad as I thought it would be. The radio is working again, but still needs alot more attention. I still have to rebuild the filter caps C603 and C606, both have corrosion leaking out. I have the caps to do it, but I am a little hesitate about jumping on that job. Does anyone have any hints on the job? I still do not know how the radio is working without the ballast tube? I can not find any jumpers or extra resistors anywhere? Well I guess it is because im a true beginner and I do not know where to look hi. I am learning more everyday, and maybe in a couple of weeks this radio will be a truly good performer. Thanks for all the help

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Date: Tue, 27 Jan 2004 16:31:35 -0500
From: Roy Morgan <roy.morgan@nist.gov>
Subject: Re: [R-390] That's more like it!!!

My opinion is that any, repeat any, modern film cap of appropriate ratings and value is fine for the R-390 A or non-A. In some spots you may need to find a cap that fits the space - some caps may be too big for the tight quarters. Voltage ratings way above the original are not needed. Use any electrolytic that fits the space in the audio module to replace the tantalum that's in there. Anyone who worries about metal film resistors having inductance is wasting their energy on trivia.

Date: Tue, 27 Jan 2004 17:08:43 -0500
From: Jim Brannigan <jbrannig@optonline.net>

Subject: Re: [R-390] That's more like it!!!

I agree, use the parts that make the radio work. The new parts are much better than the originals. However, I could not resist the challenge of re-building the power supply capacitors in their original cans. It was a lot of unnecessary work, but I'm glad I did it. I ordered the "Experimenters" kit of 1% metal film resistors from Mouser. To my dismay, they use a completely different color code scheme and the colors are not as vibrant as on the old resistors, they to be inspected carefully so the right value is selected.

From: "Cecil Acuff" <chacuff@cableone.net>
Subject: Re: [R-390] That's more like it!!!
Date: Tue, 27 Jan 2004 17:30:01 -0600

I don't know that there is any one "Accepted" cap specified by this group of believers but I think the Orange Drops are probably the most used...but certainly not the only cure for what ails these radios. I have heard of many caps of similar design being used. I for one would prefer one with the leads coming out the ends like the originals....they would be easier to mount.

From: "WF2U" <wf2u@starband.net>
Subject: RE: [R-390] That's more like it!!!
Date: Tue, 27 Jan 2004 19:05:02 -0500

What I said was: "I don't get into hair splitting as to what brand and what color cap I should put in as a replacement...". All these discussions about whether to "orange drop" it or whatever, seem to be completely ridiculous. Any ham who's attempting to do repairs on equipment, should be at least familiar with basic components and their application, i.e. the types of capacitors and resistors available, and the application by type and voltage ratings.

This is basic! It looks like sometimes someone uses a certain brand or type and then others follow it blindly and that brand/color becomes "fashionable", without the correct design procedure and part selection behind it. BTW I'm an Electrical Engineer by education and in my professional career I specialized in the design of high-power, wide-band amplifiers (typically between 10 KHz and 220 MHz, up to 10 KW), and HF tube and solid-state linear amplifiers for communication systems...

Seriously, one doesn't have to be an engineer to select parts wisely....

From: "K1KQ" <k1kq@motorhomesusa.com>
Date: Wed, 28 Jan 2004 09:09:10 -0600

Organization: Roger Agnew
Subject: [R-390] OOPS! C-553 not C533

My post should have read C-553 not C-533... Damn that spellpecker.

>> "I have decided to take the conservative approach with respect to C533 and replace it" <<

From: "K1KQ" <k1kq@motorhomesusa.com>
Date: Wed, 28 Jan 2004 09:17:05 -0600
Subject: [R-390] I sense a little SPARK! is back

Well, Well... I'm a newbee, but I sense that the posts from a couple of "Old Timers" (OT's) has put a little spark! back in the group. Great! to see, and a little humor too. OK, now a question to the "Underpaid Research Group" (URG). I have decided to take the conservative approach with respect to C533 and replace it on my newly acquired '55 Collins R390A that has been in an attic for 15 years. Mouser did not have any of the Orange drop 600v caps, so they sent me some 0.01ufd 400v & 800v Vishay/Sprague Orange Drops, which should I put in? I also read somewhere a recommendation that as long as you are at it you might consider putting 2 in parallel for back up. Comments suggestion from the OT's & URG appreciated.

From: "Scott, Barry (Clyde B)" <cbscott@ingr.com>
Subject: RE: [R-390] I sense a little SPARK! is back
Date: Wed, 28 Jan 2004 09:21:49 -0600

I seem to recall only putting in a 400V OD here. Whatever Dave (a guy on the list that offers(offered?) capacitor kits) included in his rebuild kit is what is in my radio.

From: <mahlonhaunschild@cox.net>
Subject: Re: [R-390] That's more like it!!!
Date: Wed, 28 Jan 2004 13:40:58 -0500

I quite agree. As evidence, I point out that the later EAC production used the yellow axial-lead polyester capacitors, even though Orange Drops had been around for quite some time already and the incremental price increase would have been insignificant. But then, the R-390A was a "build-to-print" design and challenging the parts list under those conditions would have been risky business. When/if I re-cap the '55 Collins I'll use the yellow polyesters (with a protective heat-shrink coat).

From: "Cecil Acuff" <chacuff@cableone.net>
Subject: Re: [R-390] I sense a little SPARK! is back

Date: Wed, 28 Jan 2004 19:31:36 -0600

Someone may have already addressed this...but I haven't read about the backup plan...but can tell you that placing them in parallel won't get the job done....series would do it but you would need to double the capacitor value because putting them in series divides the original cap values. Don't think it's really necessary...with the quality of today's components relative to yesteryears...the new caps will out live all of us and maybe our kids!

Date: Wed, 28 Jan 2004 18:17:50 -0800
From: Dan Arney <hankarn@pacbell.net>
Subject: Re: [R-390] I sense a little SPARK! is back

Try Walter Wilson's kit. I think it is better overall.

From: "Ronnie Davis" <rdavis24@carolina.rr.com>
Subject: RE: [R-390] I sense a little SPARK! is back
Date: Wed, 28 Jan 2004 22:06:00 -0500

Good information in the list today and good to see the list come alive again. I want the second Hank's recommendation on Walter Wilson's kits. I have used two of them now and they are just what I wanted and he is a fine gentleman to deal with. I am in the process of installing the second kit now. One happy customer here

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Date: Wed, 28 Jan 2004 19:33:39 -0800 (PST)
From: John Kolb <jlkolb@cts.com>
Subject: Re: [R-390] I sense a little SPARK! is back

Well, that should be two in series, not in parallel. If in series and one shorts out, the other one still prevents DC current from flowing. A single 800 V cap sounds safer than one 400V cap, but two 400V caps would be better than one 800V cap.

From: "Lee Bahr" <pulsarxp@earthlink.net>
Date: Wed, 28 Jan 2004 23:16:43 -0600
Subject: [R-390] Cap Kits

Well, I got some replies to how do you find Walter Wilson so I could order a Cap kit for my R-390A. Turns out his web page is: http://r-390a.us/ Everybody told me he is a great guy, so I ordered a cap kit as well as a screw/washer kit from him. Thanks for all the help.

From: DAVEINBHAM@aol.com
Date: Thu, 29 Jan 2004 14:21:09 EST
Subject: [R-390] Return of the ReCap Kit

I am still getting email asking about the ReCap kits. Yes, I still have a few left. For those of you who may not have been on the list a long time, what you get is 10 little Ziplock bags inside a large Ziplock bag.

Each little bag has the contents marked on it such as " (1) 50 uFd 50 V , C103 ". No searching around trying to sort out what goes where. Just get the smoldering iron hot. I guess I will just have to keep on doing the ReCap kits as long as you guys want 'em. But next time I buy capacitors the price of the ReCap kit will have to go UP a couple or three bucks so I don't loose money on 'em.Interestingly, 4 of the last 6 ReCap Kits went out of the country.

Wonder what that neans. <snip> The price for this recap kit is $80.00 US funds. Price includes UPS or US post delivery. Canada and mexico US$85. Western Europe, South America and
Pacific rim US$90, rest of world US$93. All sent airmail if possible.

ALABAMA RESIDENTS MUST ADD US$3 STATE SALES TAX

Send orders to:

Dave Holder
Biological Instruments, Inc.
820 South 29 th. Street
Birmingham, Alabama 35205-1004
USA

Payment may be check or US currency. (If you send cash put it in an envelope

inside the envelope you mail. AND IT IS ENTIRELY AT YOUR RISK) Sorry, no credit card orders. Before anyone starts to bitch about the price, please bear in mind, my gross profit will be about $3.12 per order. That should earn me something less than minimum wage..... before corporate and personal taxes. I reserve the right to withdraw this offer if it gets to be a pain in the butt.

From: "Kavanagh, George" <George.Kavanagh@FMR.COM>
Date: Thu, 29 Jan 2004 14:50:59 -0500
Subject: [R-390] ReCapping R-390A

Well there _are_ a few newbees out here (me for one), and I'm _very_grateful to those list members who have gone before and for their willingness to document and share their vast amount of R-390A knowledge and lore. I obtained a Collins R-390A last month (Serial#3319

of Order#8719-P-55). It was "known good" by its previous owner, so I fired it up and delighted in its features and operation for several weeks). I've obtained the documentation (Y2K, Rev2, etc.) to which list members directed me, and have begun to digest it. Having discovered the potential of a lurking timebomb in C-553, I resolved to open up the box & see if it had ever been recapped. After purchasing a set of Bristol Spline L-wrenches (from McMaster-Carr) I removed the IF subchassis and discovered that no recapping had been done. I think. There are several "VitaminQ" caps in the IF (C531, 533, 536, 547, 548, 549) but C-553 is _not_ a "VitaminQ", it is marked "ASTRON" "TQFP 4982" ".01 mF 300 WVDC".

** I'm sure that this C-553 should be replaced by an OD, as recommended, but am curious: was this ASTRON cap factory installed?

Also, the shaft coupler on the Bandwidth shaft was a real bear to loosen; I was afraid I would strip out my nice new spline wrench! In the end, a drop of LiquidWrench on the coupler's nut, and a touch of heat from a soldering iron on the nut did the trick. I don't think this thing has been opened up in 50 years!

** All the tube shields are silver colored. I have read that Collins started using black IERC shields at some point in production - when was that?

Recent posts to the list suggest replacing all brown color-banded caps - the IF has 11 of these, several in quite inconvenient locations that would require significant disassembly to do properly.

** Just how big a project _is_ completely recapping an R-390A?

Thanks for any & all comments and suggestions

Date: Thu, 29 Jan 2004 17:07:44 -0800
From: Dan Merz <djmerz@3-cities.com>
Subject: Re: [R-390] ReCapping R-390A

George, when I got my 390a I sort of did what you did. I took a look inside and assessed what looked bad. My basic approach is "if it ain't broke, don't fix it." But I gave in to the idea of replacing the critical cap in front of the mech. filters just because that didn't really take much work and there's nobody that says it's not going to fail eventually with serious consequences. I replaced a few others but more or less when I could tell there was a malfunction. There is one physically small, cathode bypass cap, in the audio section as I recall, that invariably seems to be bad and it's condition can be spotted and I replaced that. And I replaced the plug-in power supply caps. So far the receiver has operated pretty well. I would

say completely recapping the whole receiver is a bigggg job. My 390a is one of the later EAC types so I expect it might have more life in the original parts than some of the earlier versions. I have no experience with earlier versions so that statement is based on intuition and occasional statements from others to that effect. The general consensus seems to be that the black IERC actually cool the tubes, whereas the others are more or less ineffective, if not worse than no shield as far as cooling goes. Dan

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Date: Sat, 7 Feb 2004 21:29:47 -0600
From: Tom Norris <r390a@bellsouth.net>
Subject: [R-390] Orange Drops, not just for radio any more

Will the price of Orange Drop caps go through the roof now that the secret is out that they are good for vintage audio gear too? Check item number 3701942877 on you know where and decide for yourself. *twitch*

Date: Sun, 8 Feb 2004 06:10:19 -0600
From: Dave Merrill <r390a@rcn.com>
Subject: Re: [R-390] Orange Drops, not just for radio any more

The vintage audio crowd is showing 'rare' wisdom since the last eight auctions all ended without bids.

Date: Sun, 8 Feb 2004 08:28:24 -0600
From: Tom Norris <r390a@bellsouth.net>
Subject: Re: [R-390] Orange Drops, not just for radio any more

I guess they will only pay that much for Black Beauties..... :-) Nice to know they have *some* sense at times. I remember some fellow last year asking for, and getting $5 per for NOS BBOD's.

From: "Kavanagh, George" <George.Kavanagh@FMR.COM>
Date: Mon, 9 Feb 2004 20:11:36 -0500
Subject: [R-390] BBOD leakage

Although I realize that even if it is still "good", a BBOD should be replaced if one has the opportunity, before it fails; what leakage current is considered "acceptable" for a 0.01uF, 300v BBOD tested at 300v? A 0.1uF, 300v? Yes, it depends on the circuit in which it is used, but can someone quote how a new one would have tested 40 years ago? Thanks!

Date: Mon, 26 Jul 2004 21:04:03 -0500
From: Tom Norris <r390a@bellsouth.net>
Subject: [R-390] Re: Source for axial caps (and much more)

Just bought a bag from www.justradios.com, they sell on ebay as well, username just either justradios or just-radios. Their email is justradios@yahoo.com from 29 cents for .01@630V to 45 cents for .1@630 volt poly film Also has "Orange Drop" clones at similar prices. Good prices on filter caps as well, highest cost part is 100 mf at 450V. All new fresh, not NOS dried out caps. And they have 500 V micas. Poly film Orange Drops up to 2.2 mf! Axials to .5 mf, Orange Drops and ceramic to 1600 volts. Cap kits too with common values. I've bought all my caps from them for some time now. good stuff.

Date: Tue, 27 Jul 2004 13:08:08 -0400
From: "Christopher J Galbraith" <cgalbrai@umich.edu>
Subject: RE: [R-390] Source for axial caps

I like the 630V metallized polypropylene films made by Illinois Capacitor (IC), available through AES (www.tubesandmore.com). Pretty cheap, under a buck for 0.1uF/630V.You can get to their performance specs at this link (select the "MPW" line): http://www.illcap.com/Film.asp

Pretty low dissipation factor, rated to 105 deg C, and relatively small in size compared to SBE 715P ("Orange Drops") (but still an *axial* that fits all BA applications I've tried). If you use 630V rated ones, you may get a longer life in BA rx duty (200-350V typically), as capacitor lifetimes increase as you "de-rate" temperature and applied voltage. Good for bypass and coupling. In fact, 400V polyester units should be plenty of capacitor for bypass applications... and polyesters are rated to 125 deg F. They have a higher (worse) dissipation factor (i.e. lower Q/higher E.S.R.), but I'm not certain that would matter much. But, for not much more money (cents), I just buy the 630V MPWs for everything and simplify my life a little bit. As an aside, I'm curious why "Orange Drops" are so popular in BA restorations. They look like they're better suited (and are recommended) for audio coupling or high current/pulse bypass or filtering. I recall looking at their impedance vs. frequency once and noting that 0.1uF units were getting rather close to their self-resonance for 455 kHz applications. My thinking is that I'd like to replace these capacitors once, at least in my lifetime. We're lucky to have such nice materials and manufacturing these days.

Date: Sun, 01 Aug 2004 11:29:58 -0400
From: Bob Camp <ham@cq.nu>
Subject: Re: [Racal] RE: [R-390] Source for axial caps

Some of the places that the good old BBOD's show up in are a bit surprising based on series resonance effects. The missing element in the analysis usually is that the impedances on a tube circuit are so high that you can get away with operating well past series resonance without any

real harm. Without data on the old paper parts it would be a bit tough to know just how much we are shifting things around with the newer capacitors. There certainly aren't many posts indicating any trouble in this area though. I would attribute the popularity of the Orange Drops to two things:

1) The epoxy coating on the cap is fairly forgiving when you bump it with a soldering iron.

2) Good marketing by Sprague over the years combined with a distinctive look to the parts.

There aren't a lot of variables in a plastic capacitor. The dielectric material pretty much determines the leakage regardless of who made the part. Dielectric also is a big factor in the loss versus frequency curves provided you compare parts with similar construction. Even self resonance characteristics are fairly similar for parts of the same construction and same physical size.

There are a fairly small number of people making the film for capacitors so that's not as much a variable these days as it may have been in the past. There are a few interesting dual layer films today that didn't exist a couple of decades back but i don't think they do much for boat anchors. The availability of some of the good high frequency dielectrics has dried up in the past few years.

Fortunately we don't seem to need good Q at IF frequencies in our parts. The tuned circuits in an R390 all seem to be set up with ceramic and silver mica caps.

Construction wise you have two ways to do the plates, metal foil and vapor deposited film. The film gives you higher ESR and smaller volume. Most of what we look at are wound parts rather than stacked foil, so usually that is not a variable.

I like the Illinois Capacitor parts. They seem to work perfectly well to replace the old paper and foil parts. I tend to go for two voltage ratings. Something low for tight spaces and the 630 V's for the rest of the stuff. One side advantage of the higher voltage parts is that they generally have a bit lower leakage. Of course the best paper cap in the world leaks more than the worst plastic cap I have ever seen ....

Provided the voltage ratings are adequate and you don't get parts that are only rated to 85_C (like polystyrene) just about any modern plastic part will do a lot better than the paper parts it's replacing. I certainly would not pay a premium price for any special capacitors. It's probably a good

idea to avoid the ones that the audio guys are after because they will drive up the prices ...

Date: Sun, 1 Aug 2004 11:44:38 -0400
From: "Barry Hauser" <barry@hausernet.com>
Subject: Re: [Racal] RE: [R-390] Source for axial caps

Ooops?! I've stocked up on some yellow poly's here and there -- don't remember whether they're polystyrene or polyethylene polypropylene or what. What are the typical temp ratings of the various yellow axials?

Date: Sun, 01 Aug 2004 15:52:15 -0400
From: Bob Camp <ham@cq.nu>
Subject: RE: [R-390] Source for axial caps

Most of the polystyrene parts I have seen have been in clear cases. They tend to be low value parts. I don't think I have ever seen a 0.1 uf polystyrene part. Polystyrene is what your good old model airplane kits were made out of. The stuff has a pretty low melting point.

The two common plastics in use for capacitor dielectrics these days are polyester and polypropylene. Polycarbonate used to be an option but then the last guy making the film went out of business. Teflon is another option that is out there but it's so expensive you should not consider it for the kind of stuff we do. Mylar is a trade name for polyester so it does not count as a separate material.

Polyester is usually a 105_ to 125_C rated material. Polypropylene is commonly rated from 85_ to 105_C. Packaging can make a bit of a difference as can the size they are trying to achieve on the part. The guys that go super compact on the parts seem to rate them a bit lower in temperature . The temperature is often a "rated" temperature rather than a "failure" temperature. As long as you are not putting a lot of AC current through the parts (and we don't) *and* you de-rate the voltage by a bit you can use both polyester and polypropylene up to the 125_ or 105_C temperatures.

A quick check on all this is at http://www.illcap.com/Film.asp . The page applies to Illinois parts specifically, but most of their competitors rate parts the same way.

Orange drop capacitors are available in both dielectric materials. The 715 series that most of the audio guys like has the polypropylene dielectric.

The polypropylene material usually results in a capacitor that is larger than the equivalent polyester part. The polypropylene part will normally

have a lot less loss for a given size part (0.05% versus 1%) . The only advantage to the polyester part is that it's smaller size will normally give you a lower inductance. What ever gain you get from lower inductance normally is wiped out by the higher loss of the polyester material.

In a bypass application the fact that the polyester part has an impedance 1% higher than the polypropylene part hardly matters at all. There is no reason to pull out parts you already have installed. If you have a choice *and* they will fit then use the polypropylene parts.

How important is all of this? Well I for one don't pay any attention to it at all. I pretty much use the two types of capacitors interchangeably in R390 rebuilds. Epoxy coating is nice, but keeping the soldering iron away from capacitors isn't all that tough. I often can succeed at it three times out of four.

Date: Tue, 03 Aug 2004 13:10:23 -0400
From: Roy Morgan <roy.morgan@nist.gov>
Subject: Re: [Racal] RE: [R-390] Source for axial caps

PolySTYRENE caps are usually clear, you can see the foil inside through the
stuff. See the (poor) picture at:
<http://www.industrialnewsroom.com/fullstory/8253>
The common polystyrene cap is the right most one. (It may be that the other ones shown are also styrene.) Note: polystyrene caps are normally rated at 100 volts or less but one outfit seems to have stocks up to 630 volts: see: <www.seacorinc.com> or:
<http://www.seacorinc.com/products/capacitors/tables/precision.asp>
Where you will note that the styrene caps have one tenth the dissipation factor and three times the leakage resistance of the polypropylene units in the same table.

This link is a nice comparison chart showing many common dielectrics and their significant characteristics:
<http://www.seacorinc.com/products/capacitors/tables/dielectrics.asp>

I see from this data the styrene caps have a negative temp coefficient. This may give us a way to determine if a cap is styrene or not. The caps that are usually yellow are poly-something-else. If your caps are recently made, you can check manufacturers specs for the particular ones you have for details. I think you have nothing to worry about.

Date: Mon, 10 Jan 2005 08:08:04 -0600
From: "Dallas Lankford" <dallas@bayou.com>
Subject: Re: [R-390] Servicing Advice on Signal Generator URM-25D

Sure. Let me prerface my remarks by saying that much of what is said about preventive maintenance on the reflector is baloney.

Take, for example, the "resistor replacers." You can't measure most resistors accurately in circuit unless you "lift at least one end," and if you do that, you might as well go ahead and replace it. Ditto for the "capacitor replacers." Unless there is some strong reason to replace a component (it is burnt dark brown or black, cracked case, oil leaking out, hot enough to boil water, etc.), leave it alone. Just because the case of a capacitor is black or brown does not mean it should be replaced. To illustrate how silly that is, I could say (tongue in cheek) replace all capacitors with a yellow case. Would you do that?

There are, of course, a few cases where you should replace capacitors. The mechanical filter blocking capacitor of an R-390A is an example of such a case. Now I don't really believe the story that the R-390A filter blocking capacitor failed in some R-390A many moons ago, and the operator switched through all the filters "killing" all the filters before he discovered what had happened. But because I don't want to tempt fate, I have replaced that cap with a disc ceramic cap having a much higher voltage rating in all of my R-390A's. And any black case cap in an SP-600 should be replaced immediately before you even turn it on (but you can usually see the cracks in the cases of the SP-600 "black beauties").

As for the URM-25D, every one I have seen has tan cased MicaMold oil filled capacitors, and at least one of those is leaking oil. Some of them are tough to get to, but every one should be removed and replaced. I like the "yellow wraps" available from AES for replacements.

Personally, I would never convert any tube rectifier power supply to solid state, if only for aesthetic reasons. Tube rectifier power supplies "come up gently." If you convert to solid state, every time you turn your gear on is like hitting it with a big hammer. And anyway, what is the point of removing tubes from tube gear? Too cheap to buy the appropriate rectifier tubes? If we are going to remove the rectifier tubes, let's remove all the tubes!!! And then why buy tube gear and convert it? Let's just buy stuff that is already all solid state!!!!

And electrolytics... dare I bring up that topic again.? I think not because the doctor is probably lurking and I am not in the mood right now for a tussle. But here is a war story I don't think anyone can object to. A European friend of mine sent me his Telefunken E 1501 to fix. While fixing it I noticed that the power supply was quite noisy (loud mechanical hum). The E 1501 is modular, so I removed the power supply module to give it a look-see. While I was examining the power supply I noticed that a

previous owner replaced two of the electrolytics in a misguided attempt to reduce the mechanical hum. Why have I concluded this? Because the "zipper crew" did not remove the old elctrolytics, but merely "scabbed in" the replacements. So I measured the resistsances of the old electrolytics with my DVM. They seemed fine (no shorts, no leaks, reasonably high resistance after charging for a while). Later I will actually power up the electros with a DC supply and check them for leakage under operating voltage. If they pass that test, I will remove the replacements and restore the originals. I gave seen this kind of thing before in a Hammarulnd HQ-180A. Fortunately, that zipper crew also left the old electrolytic can in place, and I restored it. Have fun, Dallas (ed. also posted under restoration_general)

Date: Mon, 10 Jan 2005 20:43:26 -0500
From: Bob Camp <ham@cq.nu>
Subject: Re: [R-390] Servicing Advice on Signal Generator URM-25D

I asked this back a few years ago and maybe it's time to ask it again. Has anybody seen any of the black or brown body/epoxy coated paper and foil capacitors made in the 1950's and 1960's show up good? As originally asked the question was specific to the R-390. Since then I have seen a bunch of posts on a number of reflectors about these parts. They all seem to indicate these parts are a problem. At least in my experience, testing pulls from a couple dozen radios they show up leaky (as in 5X out of their original specification) roughly 80% of the time. They show up at least 2X the specification >90% of the time. Certainly there are places where you will not notice leakage even if it is 5X the specification. Most of these seem to get used in high impedance circuits where you will notice the effect though.

Date: Mon, 10 Jan 2005 20:19:18 -0600
From: "Dallas Lankford" <dallas@bayou.com>
Subject: Re: [R-390] Servicing Advice on Signal Generator URM-25D

I have never seen a black capacitor in an R-390A. You must be confused. The bad black capacitors were in the SP-600's (except for some of the very last production, which had disc ceramics). If any of those black beauties were in an R-390A, you wouldn't have to test them to figure out they were bad. You could see the cracks. I seem to recall that there were other black capacitors from the 50's that were O.K., but don't quote me on that.

Date: Mon, 10 Jan 2005 20:47:28 -0600
From: "Dallas Lankford" <dallas@bayou.com>
Subject: Re: [R-390] Servicing Advice on Signal Generator URM-25D

<snip> Black beauties? Where are the "black beauties" in an R-390A? I

have seen lots of R-390A's, from the first production Collins's and Motorola's to the 1967-68 EAC's, and I have never seen a black capacitor in an R-390A. Surely you are confused, and thinking of the SP-600.

Date: Mon, 10 Jan 2005 21:01:23 -0600
From: "Dallas Lankford" <dallas@bayou.com>
Subject: Re: [R-390] Servicing Advice on Signal Generator URM-25D

Brown beauties are wonderful and should be preserved for posterity. I tested several of these a few years ago when the doctor told me all were bad. Guess what? Mine were all good.

Date: Mon, 10 Jan 2005 22:09:17 -0600
From: "Cecil Acuff" <chacuff@cableone.net>
Subject: Re: [R-390] Servicing Advice on Signal Generator URM-25D

There are brown colored capacitors that resemble the design of the black beauty cap. I think it has been accepted by most that those caps are as prone to failure as the black beauty and they are being replaced for that reason.

Personally I haven't had a chance to check any of them to see if they have the same leakage characteristics as the infamous black beauty or not. I can't say I have noticed any that are cracked, but I do believe I have heard stories about some that were found to be.

I'm not sure what the Pro's who are restoring these radio's for profit (I use that word loosely... I've been there) are doing...I expect a wholesale replacement of paper caps as evidenced by the cap kits that are offered by some. Problem is if you leave them in you will always be nagged by that question floating around in your mind about whether the performance could be improved by replacing them. You could lift one end and check them as long as you do it correctly by measuring them at their rated voltage...but by that time you are half way to replacing the darned thing so why not go ahead and finish the job...right! I don't know...what's the right answer...is there really any harm in replacing them if you are up to doing the job and it's done properly. Is there any documented evidence that replacement degrades performance...I would guess not.

Resistors...now they are a little easier. Not hard to measure usually. Some spot checks will usually give you a pretty good idea if work is needed or not.

I certainly don't advise unnecessary replacement of parts....but for the most part paper caps have a very bad reputation. I don't trust them!

Date: Mon, 10 Jan 2005 23:26:23 EST
From: N4BUQ@aol.com
Subject: Re: [R-390] Servicing Advice on Signal Generator URM-25D

I know the brown beauties in my Motorola decks were visibly cracked and, therefore, had probably taken in moisture and as a result were most likely bad. I replaced them wholesale with OD's. Not sure if I'll do the same on the current unit as the ones in it appear physically in better shape, but I think I'll probably replace them. I've just heard too much about the life expectancy of them to take chances.

Date: Tue, 11 Jan 2005 20:35:17 -0500
From: Bob Camp <ham@cq.nu>
Subject: [R-390] Caps and more caps

I must be shopping for my R-390A's at the wrong store. Of corse I don't seem to see very many modules from later builds. Certainly the later modules I have seen have plastic insulation parts rather than paper insulation capacitors.

I have found both black and brown coated tubular paper capacitors in R-390A's. I agree that cracking is pretty common in the black version and less common in the brown ones. As far as I can tell the contractors either got a deal on black ones or brown ones. The modules rarely have a mix of black and brown parts.

What got me started on all this capacitor stuff was a pair of IF decks both with black caps. Both decks had at least some of the capacitors cracked. In both cases all of the paper caps leaked a lot. I carefully removed each of them in a fashion that I could reasonably solder them back in. Needless to say this is a bit more work than just yanking them out. All that work was wasted in those cases.

Now I normally check one capacitor in a module by lifting the ground lead. If it is leaky then I step through the rest of the caps on that module clipping each one out and testing each of them. I have yet to find very many of the paper caps (brown or black) that did not leak quite a bit when biased at > 60 volts and observed for long enough to stabilize the current.

The plastic insulation capacitors I replace them with test just fine on the same test. Interestingly they don't even leak at a level close to their specification. That's what I would expect from a good capacitor of this type, leakage well below the specified maximum.

The only exception I make are for the filament and thermostat bypass capacitors. As far as I can see they could leak an awful lot and not have

much affect on anything. I generally don't fiddle with them unless they are cracked or otherwise visually defective.

One thing that I started out doing on the paper caps and then stopped doing was to check the capacitance. I found a number of parts that leaked but never found one that was off value. I don't know if this is true across the board or not. I assume it's valid though.

Electrolytics on the other hand certainly leak, change value and change ESR. I never have checked ESR on the paper parts ... I check the electrolytics for both leakage and value. With an electrolytic I don't worry about the leakage until it's about 5X the specification. I don't see how an extra few ma of current in a power supply bypass cap is going to bother the radio much at all.

By no means am I suggesting we throw away good parts. Life is to short to spend it bulk swapping one good part for another. I simply have not seen enough of the paper caps show up good yet to make it worth saving any of them. If four out of five are bad who knows how long the fifth one will hold out .... I agree that in one case out of 4 that makes for a good part / good part swap but that's the choice I make.

Date: Tue, 11 Jan 2005 19:54:14 -0600
From: "Dallas Lankford" <dallas@bayou.com>
Subject: [R-390] Re: Caps and more caps

Perhaps you are shopping at the wrong R-390A store, but it is far more likely that you are mistaken. I have carefully inspected and rebuilt between 10 and 20 R-390A's, and a good friend of mine has carefully inspected and rebuilt well over 100. Neither of us have ever found a bad (cracked or otherwise) brown encapsulated paper capacitor in an R-390A Neither of us have ever seen a black encapsulated capacitor in an R-390A, period. We have found bad capacitors in R-390A's, but they were all (red or green) silver micas, and most of those were in oscillator decks.

Clearly you and others have decided to replace capacitors come hell or high water. So be it.

If it will make you feel any better, I did replace a brown beauty (or maybe two) in a 1968 EAC IF deck whose BFO long term stability was not as good as I thought it should have been (about 1 Hz per hour or so). But I don't believe the brown beauty was the cause. I believe it was a silver mica. I replaced the brown beauty and other components at the same time rather than replace one at time because I was in a rush, so I don't really know which one (or more?) was bad.

Date: Wed, 12 Jan 2005 06:04:46 -0500
From: Walter Wilson <wewilson@knology.net>
Subject: Re: [R-390] Re: Caps and more caps

I keep a bag of old capacitors that I've removed from R-390As. I randomly pulled 10 of the brown tubular ones out of the sack this morning. I counted 7 of those with cracks. While it is certainly true that not all capacitors need to be replaced, I'd err on the side of replacing too many than too few, especially if it is filled with the brown tubulars.

Date: Wed, 12 Jan 2005 06:22:46 -0600
From: "Dallas Lankford" <dallas@bayou.com>
Subject: Re: [R-390] Re: Caps and more caps

I do not believe you. The laws of statistics say that if 7 out of 10 brown beauties were cracked (as you claim), then my friend and I would have observed several hundred cracked brown beauties. The odds of us seeing none (which is what we saw) are way beyond 1 in a trillion.

Date: Wed, 12 Jan 2005 06:54:53 -0600
From: "Dallas Lankford" <dallas@bayou.com>
Subject: [R-390] Note To The Capacitor Replacers

If you all are talking about those rained-on, snowed-on, sun-baked, frozen, left in the parking lot for years, or otherwise abused R-390A's, then my remarks about capacitors do not apply to them. I would not touch one of those with a 10 foot pole. There are people who believe they can be rebuilt. I don't. I wouldn't buy any R-390A nowadays that I couldn't personally inspect before I bought it, or that didn't come with a return guarantee that it hasn't been abused.

Date: Wed, 12 Jan 2005 08:29:46 -0500
From: N4BUQ@aol.com
Subject: Re: [R-390] Re: Caps and more caps

Again, I can only concur with Walter. A large percentage of the "brown beauties" in my '56 Motorola had cracks that could easily be seen. I don't think mine was abused, but just old.

Date: Wed, 12 Jan 2005 07:32:25 -0600
From: "Dallas Lankford" <dallas@bayou.com>
Subject: Re: [R-390] Re: Caps and more caps

What you and Walter have said violates the laws of statistics. That is why I say I don't believe you. Are you and Walter friends?

Date: Wed, 12 Jan 2005 16:02:36 +0200
From: "Bryce Ringwood" <BRingwoo@csir.co.za>
Subject: Re: [R-390] Re: Caps and more caps

Doesn't it depend on where the caps are stored / used ? I'm sure that caps in Durban (a hot sweaty salty place) will be cracked and corroded long before caps in a mild dry climate like I'm used to. It might account for the statistical differences.

Date: Wed, 12 Jan 2005 07:58:20 -0600
From: "Dallas Lankford" <dallas@bayou.com>
Subject: Re: [R-390] Re: Caps and more caps

Yes. Of course, you are right. This is basically what I said a few emails ago which, apparently, the capacitor replacers failed to read. So here it is again for those who missed or ignored it the first time around. If you all are talking about those rained-on, snowed-on, sun-baked, frozen, left in the parking lot for years, or otherwise abused R-390A's, then my remarks about capacitors do not apply to them. I would not touch one of those with a 10 foot pole. There are people who believe they can be rebuilt. I don't. I wouldn't buy any R-390A nowadays that I couldn't personally inspect before I bought it, or that didn't come with a return guarantee that it hasn't been abused.

Date: Wed, 12 Jan 2005 08:20:09 -0600
From: "Dallas Lankford" <dallas@bayou.com>
Subject: [R-390] Old Brown Beauty Statistics Lesson

Disclaimer: "If you all are talking about those rained-on, snowed-on, sun-baked, frozen, left in the parking lot for years, or otherwise abused R-390A's, then my remarks about capacitors do not apply to them. I would not touch one of those with a 10 foot pole. There are people who believe they can be rebuilt. I don't. I wouldn't buy any R-390A nowadays that I couldn't personally inspect before I bought it, or that didn't come with a return guarantee that it hasn't been abused."

The fact that your R-390A was an (old) Motorola [see below] does not change the fact that your claims violate the laws of statistics. Among the R-390A's that I have carefully inspected and rebuilt were two 1956 Motorolas. Let's see... how many brown beauties were in those two. I am not sure. There were about 12 each in the IF decks, and at least 1 each in the RF deck. That is a total of 26. If on the average we would expect out of 10 to be cracked (your claim), what is the probability that none were cracked (my observation)? The answer is simple statistics. Multiply 3/10 by itself 26 times. That is 2.5419 time 10 to the -14 power. So the odds that I would observe none when you observed 70% cracked are 1 in

254,190,000,000,000. This violates the laws of statistics. The above does not include a 3rd Motorola IF deck that I still own, in which none of the brown beauties were cracked or bad. If I included it, the odds would be even more outrageous, namely 1 in 1.3509 times 10 to the minus 20. BTW, both of those Motorolas are alive and well (about 20 years after I rebuilt them), with none of the brown beauties replaced (and none have cracked or gone bad in the meantime). The only problem which has developed in either is a switch which will not turn off in one of them. The owner, who lives nearby, is too lazy to bring it by for me to fix.

Date: Wed, 12 Jan 2005 08:43:38 -0600
From: "Cecil Acuff" <chacuff@cableone.net>
Subject: Re: [R-390] Re: Caps and more caps

The storage issue may be true.... What is also true is that as well versed in Statistics as Mr. Lankford appears to be he should also recognize that the 10 to 20 radio's he has had experience with is way too small a sample relative to the total production numbers of R-390A's through the years to be speaking in the absolutes he is! That holds true even if you can take credit for your Friends 100 or so Dallas. I'm not a math nor statistics Professor but a mere trade school
grad with nearly 40 years of hands on experience (and still working 40 to 60
hrs. a week) and one thing I have learned is that in this business anything is possible....except when we close our minds. You never say never and just when you think your experience with something is "Absolute" you find out differently!

On the subject of the "Blue Stripers" there are many on this list including myself that own, have already or are in the process of rebuilding them. I probably requires more work but it's worth it! It's arrogant of you to tell these people that they don't possess the skills to pull it off just because you are unwilling. There are very few of the pristine surplus R-390A in the market anymore..most are tired old depot hounds that deserve our time and expertise too! Heck who wants to do the easy ones....that's no challenge!

Keep an open mind Dallas...there's more to learn yet!

Date: Wed, 12 Jan 2005 09:06:05 -0600
From: "Byron Tatum" <bjtatum@ev1.net>
Subject: [R-390] Capacitors

Regarding the R-390A capacitor thread I will throw in this observation: On an older IF module { Collins built } the type of capacitors were the large tubular ones that appeared black, as best I remember, with color-

coding rings around them.They appeared as if they were made in two halves, with a seam running between top and bottom halves. I recall finding one of them, mounted over against the side wall, in the area of the BFO / detector, that was separating at the seams. It was very noticable. Anyway, the day I bought this IF deck { at a swap meet, by itself} a good friend of mine was looking it over and commented about this type of capacitor. I thought he referred to it as a "Black Beauty". Anyway, he told me these type capacitors were notorious for problems { leakage} and one could actually have a tiny battery type effect in a circuit. { Dallas, this friend of mine purchased your modified 51J4 about 10 years back} I put stock in my friends advice as he has restored many, many older radios and would remove these type capacitors upon sight. Anyway, just a bit of information to chew on.

Date: Wed, 12 Jan 2005 10:33:25 -0500
From: N4BUQ@aol.com
Subject: Re: [R-390] Re: Caps and more caps

Well, if I still had the caps (they're residing in the landfill at the moment), I could send them to you. But, then again, you might not believe I took them out of an R390A so it would be pointless. While I've never met him, I'd like to think Walter is a friend of mine.

Date: Wed, 12 Jan 2005 09:38:54 -0600
From: "Cecil Acuff" <chacuff@cableone.net>
Subject: Re: [R-390] Re: Caps and more caps

Actually Dallas I went out last evening and looked at two of my "Blue Striped" radios and found no cracked capacitors. The underside of all the modules were pristine. Not sure the St. Julians Creek pile was subjected to a whole lot more than some that were deployed in Vietnam from the reports I have heard from actual users of the radios there.

Date: Wed, 12 Jan 2005 09:32:33 -0600
From: "Dallas Lankford" <dallas@bayou.com>
Subject: Re: [R-390] Re: Caps and more caps

You are right. I wouldn't believe you. Statistics say your claim is impossible, unless your R-390A was abused, which you say it wasn't. The only one of your group that I believe so far is Cecil who admitted his R-390A with cracked brown beauties was rained on, et al.

Date: Wed, 12 Jan 2005 10:02:22 -0600
From: "Sam" <sdman@cableone.net>
Subject: [R-390] Caps, Caps, Caps

Someone please take a picture of a R390A with "Black Beauties" or "Brown Ones" so Dallas can see for himself. Dallas you seem like an oustanding guy but aren't you are being a little rude to the guys on the Forum? Give them the benefit of the doubt. Wasn't there over 50,000 R390A's produced? Seems like a very small sampling that Dallas used. What was that saying on Statistics? If you stand with one food in a bucket of hot water and the other in cold you are on the average comfortable.

Date: Wed, 12 Jan 2005 08:53:03 -0800
From: "David Wise" <David_Wise@Phoenix.com>
Subject: RE: [R-390] Re: Caps and more caps

I did. For what it's worth, my used-but-not-abused '56 Motorola, which contained browns*, had one that was visibly cracked and leaking oil (or whatever it is. The Cost Reduction Report calls them "Prokars", which I seem to remember had a plastic-impregnated paper dielectric**). I can't remember the details (they might be in the archive), but there are at least a few nets in the IF deck that you can charge with a HV power supply and directly or indirectly measure the aggregate leakage of several caps. I did so, with the deck in a low (120F) oven, and it averaged a few hundred uA per cap at their rated voltage of 400V. One cap shorted overnight. I replaced it, the cracked one, and those in high-impedance locations. Left the others. After a couple years of frequent use, I haven't seen any problems.

* Except for a Black Beauty in the RF deck, which I replaced on sight.
** If you know this is wrong, please say so and stamp out bad data.

> period. We have found bad capacitors in R-390A's, but they
> were all (red or green) silver micas, and most of those were in oscillator decks.

You probably mean molded micas. I replaced one mech. filter-tuning one that was intermittent.

Date: Wed, 12 Jan 2005 11:56:05 -0500
From: <robert.boyd@sdc-dsc.gc.ca>
Subject: [R-390] R390A Caps, Caps, Caps ad nauseaum

Much as the back-and-forth is amusing, the bottom line is that in 40-50 year old equipment (including the undersigned) components may have to be replaced. What is a bit distressing about this is that having been a list/forum member for almost a year and just salivating to get my hands on one of these beauties I'm seeing the level of discourse on the "capacitor replace or not" topic slip, to put it mildly. Since I have your attention I'd like to request that any member having an extra R390A (or R392) that

he'd like to part with to contact me off list. I promise to replace capacitors only when judged necessary

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Date: Wed, 12 Jan 2005 09:59:40 -0800
From: Dan Arney <hankarn@pacbell.net>
Subject: Re: [R-390] Re: Caps and more caps

Well I bought 18 Blue-stripers and have totally restored 8 of them: which have gone to happy homes with no complaints and no cracked Brownies with all of the modules insides is pristine condition. Replaced a lot of caps and rebuilt the 2 cans and have labeled them as rebuilt.I have a few non-blues in worse condition. They take a lot of effort and TLC to bring them up to speed. Mine will stand up with the best of them. Hank KN6DI

Date: Wed, 12 Jan 2005 17:31:09 -0500
From: Walter Wilson <wewilson@knology.net>
Subject: [R-390] Pictures of cracked brown beauty capacitors

Look here to see pictures of the seven cracked ones I discussed:
http://r-390a.us/bad_capacitors.htm

Date: Wed, 12 Jan 2005 17:46:08 -0500
From: JMILLER1706@cfl.rr.com
Subject: Re: [R-390] Caps, Caps, Caps

I have several NOS black beauties of various values available for any interested parties. These are pristine, never used, still with nice long unsoldered leads. Let me know. As with all old electronics, these are offered strictly "as-is".

Date: Wed, 12 Jan 2005 22:29:04 -0500
From: Walter Wilson <wewilson@knology.net>
Subject: Re: Fw: [R-390] Old Brown Beauty Statistics Lesson

I've taken no offense at this discussion. It is a lively one, though. Where is Joe? He is usually the one stirring the pot. Honestly, I'd always replace the brown beauties because almost all that I've tested leak way more than the others (yellow aerovox, metal vitamin Q, or new orange drop). Even the good brown beauties are quite leaky, and the cracked ones are typically much more leaky. I've tested enough to form my own opinion. And yea, we're all entitled to forming our own opinions. I guess one of the reasons I replace some capacitors without cutting loose one end and checking for leakage is 1) I enjoy working on radios, and replacing caps is not a boring task to me, and 2) I want these 50+ year old radios to last at least another 50 years. I don't want to have to come back in 5 or 10 years and go through the exercise again of searching for a bad capacitor. But

that's just my opinion.

Date: Wed, 12 Jan 2005 22:42:03 -0500
From: Bob Camp <ham@cq.nu>
Subject: Re: [R-390] Old Brown Beauty Statistics Lesson

A couple of thoughts about why the capacitors crack.

There are a significant number of electronic parts out there that get a plastic coating over them when they are manufactured. Some of the coatings are relatively soft and will stretch a little. Others are fairly brittle and don't stretch much at all. Most plastics are made by cross linking long molecules together. The more linking you do the more brittle they get and in some cases the more they shrink. Other plastics are sensitive to humidity. A great example is Nylon. If you have ever seen nylon hardware that has been out in a hot dry location for a couple of years it's amazing how much the stuff shrinks.

I have personally been involved in a couple of *very* painful recalls on epoxy coated parts over the last 30 years. In each case the epoxy slowly shrank over time. The net result in one case was thermistor that popped open like popping corn. The net result in the other cases where tuning capacitors that went out of alignment and shorted out. I suppose that if necessary I can dig up the GIDEP's on all of them. In all cases these were parts used in military equipment. Rockwell Collins, TI, and Magnavox (Ft. Wayne) were the end customers.

Bottom line in each case:

1) The ratio of hardener and resin is pretty important in an epoxy. The normal methods mixing the stuff are surprisingly open to error. Is it equal parts by volume or by weight. Do you mix each can before measuring.

2) Regardless of the chemistry plastics continue to cross link after they are judged to be "fully cured". In some cases this is accelerated by humidity. In most cases it is accelerated by radiation. In all cases that I have been made aware of it is accelerated by heat.

3) Thermal cycling of the shrinking case wrapped around a hard inner core will also accelerate the cracking, crushing, or moving process.

So much for the intro, but this is a thread for the long winded.

Now for the variables:

Radio A: Runs 24 hours a day in a tight rack for 20 years on board a ship.

Nice salt content in the air even with the high temperature inside the rack.

Radio B: Sits in a open air hut in far off land for 10 of those years and then is in storage in who knows where for 10 years. Used 6 hours a day 4 days a week when in service. Radio is rack mounted, but the rack has wide open ventilation.

Radio C: Run in the continental US, inside a climate controlled building. The guard guys run it two days a month for six hours. Radio is the only thing in the rack.

All of these radios have a very plausible carrier in the military. Certainly we would all like to get radio C if we could. I would suggest that a lot more radios fall in the A and B categories. Somehow I doubt we are arguing about radio C so we'll simply drop the "baby doll" radios at this point. If you just look at time and temperature on radio A and radio B there is an enormous difference in what happened to each radio. This is not to say that is the only variable. It certainly isn't. Radio A saw 10X the time on power over the 20 years as compared to radio B. Common temperature measurements of the inside of the Navy racks put them up at about 60C or so. Best guess on the average hut would be 20C. If the acceleration factor is 2X per 10C rise (activation energy below 20C ...) then radio A gets 2^4 more stress. Net result is that radio A sees about 160 times more stress than radio B. I would humbly suggest that radio A is going to have a *different* set of problems than radio B. Most of us would be hard pressed to say that radio A has been more abused than radio B by visual inspection.

Regardless of weather the caps crack or something else goes radio A is a lot more likely to have had problems of a certain type over it's life than radio B. So far I *hope* none of this is to controversial. It's pretty much straight out of MIL-HBK-217.

Here's the part that makes for the problem.

Depending on how good the maintenance on the radios was it's a total toss up as to weather radio A, B, or C is in better condition today.

It is my contention (and I suspect that you *might* agree with this) that we routinely go well past the previous "standard" when it comes to working on these radios. I won't argue weather we are going above or below the standard, only that a lot of people these days do a lot more work on these radios than was done in the past.

Is a leaky capacitor for instance a problem? That depends on who is doing

the maintenance. In one case a radio that meets minimum specifications on the bands of interest never gets pulled or worked on. In another case the radio is worked on until it meets "bragging rights" specification levels. The first case probably has a very different opinion of what is a bad cap than the guy in the second case.

Unless we agree on what is and isn't a bad capacitor I suspect we'll be at this for the next hundred years. Somehow I doubt we will come to anything other than an agreement to disagree

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Date: Wed, 12 Jan 2005 21:45:21 -0600
From: "Cecil Acuff" <chacuff@cableone.net>
Subject: Re: Fw: [R-390] Old Brown Beauty Statistics Lesson

Sounds like a good philosophy to me....especially if you are taking someone's hard earned cash to do a restoration. Who wants to get one back only to find one of the paper caps that you didn't replace has caused you so much grief.

Date: Thu, 13 Jan 2005 12:42:20 +0800
From: "J.Byers" <face1941@iprimus.com.au>
Subject: [R-390] Re-R390 Putting a Cap on Caps

This subject is getting out if hand and seems to have been been aided and abetted by a post making an overly simplistic statement on statistics. (Accurate on paper, perhaps, but not in practice) With some trepidation I submit these observations.

1. We all know there were many manufacturers of the R390 series, apart from Collins

2. Its HIGHLY unlikely the caps referred to were ALL sourced from the same manufacturer so that its equally unlikely ALL R390's EVER made had caps fitted which were came from the same production line

3. The quality of caps made by different factories WILL vary, even if the initial tests on these caps satisfied the militray procurement criteria.... which dictated a 'normal' service life of these components, and which ALL of them seemed to pass OK

4 These fine receivers are all well past their (military) 'use by' date .

5.. SO ANY STATISTICS DONE MUST ALSO INCLUDE A 'Q' FACTOR ALLOWING FOR SUCH MANUFACTURING DIFFERENCES ON THE EXTENDED LIFE OF THE 'C's' !

Ie : Consistency of potting mix, property spread of dielectric material,

sealing of wire ends to mould and probably many other things I don't know about to boot !

6. Dummer was a respected UK scientist , specialising on component reliability, who published a great deal of information on this subject via UK HMSO. There were a few of his articles in the old Wireless World on this and I remember reading one of his text books which discussed such moulded types as dicussed here.. He mentions that a major source of failure was moisture creepage along the wire ends getting into the mould cavities (Ie cavities filled by wire and the 'C' guts). The effect of corrosion caused by moisture is to pressurise the internals which can lead to cracking of the casing. This leads to more moisture ingress and is comulative. Improvements to wire sealing within the mould were one of his suggestions at the time.(Of course there are other failure modes apart from this) So any 'statistics' should show runs of receivers with failures rates higher than others based on the MANUFACTURERS FACTORY through which component sourcing may be traced. (I am merely repeating what an acknowledged expert on component reliability has already said) Indeed, it may be that a single R390 had MULTIPLE CAP SOURCES from different manufacturers in order to keep contract production rates going !

SO: WALTER was quite correct in his statement.that such caps were consistently cracking. And the others may well be correct in their observation that none had cracked ! Its likely that the spread band of good and bad 'C's may well be due to effects as noted above (in addition to many other 'noise' factors as well, such as exposure and electrical overstressing, etc etc.)

NOW I am restoring my own R390. I WILL RETAIN AS MANY OF THESE COMPONENTS AS I CAN simply because I like the look of them and they ARE part of the history of the receiver. !!! YES, ITS A NOSTALGIA THING !! I can afford to do that as I am capable of and will be fixing it myself (I will replace ALL critical 'C's' as gleaned from all you experenced fellows out there, which is what Mailmans excellent service is all about) BUT: If I were given the job of restoring someone else R390, I WOULD TEND TO REPLACE MOST, IF NOT ALL these parts ,,,,,,,,,,, depending on what my clients wishes were. After all, resistors and wire end capacitors are relatively inexpensive things to replace And my reputation on doing a professional job of repair would depend on so doing To check each Cap PROPERLY you have to lift off at least one end, and to my mind once youve gone that far your half way to replacing the thing with a modern, much more reliably made one But.... and there's the rub.... its not 'original' any more, is it? That too may be important to both a repairer and a client. Lets end this silly bickering BOTH sides may just be right enough in their own observations John Byers

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Date: Thu, 13 Jan 2005 00:46:16 -0500 (EST)
From: <w9ya@arrl.net>
Subject: Re: [R-390] Re: Caps and more caps

Um, could "it" be something as simple as Dallas' experience is several years older than those that are starting to see age, among many other factors, affecting what appears to be such different experiences ? On second thought - NAH.

Dallas has to be right and all of us that work on thousands of pieces of both old and new electronic gear for a living and have to replace capacitors are just plain wrong.

Removing my tongue from my cheek: Quite simply I service equipment that has NEVER - EVER left a climate controlled environment, quietly doing its' specific job(s) and sitting along side other such equipment in racks. And I replace capacitors all the time. Been doing this for over 35 years. And I am paid to look at many such pieces of gear EVERY working day. I replace may more capacitors than resistors, IC's, transistors, etc. Capacitors are a close second ONLY to the fuses I replace. And modern capacitors are MUCH better made than the older paper ones.

(Fuses often need to be replaced simply due to aging effects. i.e They often tend to sag over time and eventually break in equipment that (almost) never gets turned off. Capacitors also show various susceptibility due to a variety of factors. More on other factors immediately below.)

Why is my experience so much different that Dallas and his friend?

Even the new stuff can fail repeatedly in ways; such factors as issues during a manufacturer's specific batch runs, atmospheric control issues during manufacture or stock storage BEFORE initial installation. I am sure many of us can thing of MANY other such factors that Dallas simply has not take into account with his simplistic math.

Dallas I appreciate all you have done for the r390 community to date. I would prefer that my opinion of your talents remain focus on that and not in your quite unbelievable argument(s) concerning capacitors. Yes it IS possible to have your experience, but it is statistically too small a sample to have any meaning. As is your friends' experience.

Date: Thu, 13 Jan 2005 18:15:46 -0500
From: Bob Camp <ham@cq.nu>
Subject: Re: [R-390] Old Brown Beauty Statistics Lesson

The only parts being talked about here are leaking capacitors in high

impedance circuits. The reason we know they leak is because we measure the leakage. We replace the capacitors that are broken. Your position seems to be that a part that is broken (it is out of spec) AND is in a part of the circuit where that affects the performance of the radio should be left in place. I simply do not understand this approach at all.

Date: Wed, 16 Mar 2005 09:24:57 -0600
From: "Barry" <n4buq@aol.com>
Subject: [R-390] Cap Question

Looking at the caps in my "new" R390A RF deck, I'm considering replacing the three brown beauties in it. I'm curious, though, about two of them. They are used in the heater thermostat circuit of the crystal oscillator can. In the picture referenced below (thanks, Don), they are the big, yellow ones in the upper right corner:
http://militaryradio.com/Images/390rfd.jpg
The heater voltage is 6.3VAC and I'm wondering why the designers used 400V or better caps here. Is this necessary because the noise spikes are considerably larger than 6.3V or is it possible that these were just handy since there were so many other 0.1mfd @ 400V caps used in other places in the radio.

Date: Wed, 16 Mar 2005 09:42:11 -0600
From: "Cecil Acuff" <chacuff@cableone.net>
Subject: Re: [R-390] Cap Question

Looks to me like they have already been replaced. Someone may have just used what was on hand. Looking at the solder joints and the insulating tubing it looks like recent (relative) work. Maybe from a Mil. Overhaul.

Date: Wed, 16 Mar 2005 10:33:02 -0600
From: "Barry" <n4buq@aol.com>
Subject: Re: [R-390] Cap Question

I should clarify. My RF deck has the original brown beauties in it. I just used the picture as reference to show which caps I was talking about. I agree: these look like they are replacements. In my first RF deck rebuild, I replaced these with 400V Orange Drops, but they were a real pain to position and I was wondering if ratings like this are needed in this circuit.

Date: Wed, 16 Mar 2005 17:42:05 -0500
From: Bob Camp <ham@cq.nu>
Subject: Re: [R-390] Cap Question

As far as I can see there is no reason at all to *need* 400 volt caps on the filament circuit. There is also no real reason to worry about leakage on

filament bypass caps. I would leave them in place unless they are obviously damaged.

Date: Thu, 17 Mar 2005 10:42:17 -0500
From: Roy Morgan <roy.morgan@nist.gov>
Subject: Re: [R-390] Cap Question

>Looking at the caps in my "new" R390A RF deck, I'm considering replacing the
>three brown beauties in it.... in the heater thermostat circuit of the >crystal oscillator can. ... they are the big, yellow ones in the upper right corner:

The yellow caps in the picture are not brown beauties. They are yellow. That means that they are metal film caps, not paper-foil caps. Leave them be. The fact that they are in the 6.3 volt heater circuit means that any leakage in a cap would not cause the trouble we avoid when we replace paper caps.

In a nutshell:

- The yellow caps are almost certainly metal film and not paper dielectric.
- *Paper* caps are the ones to worry about.
- Leakage in caps in such places as screen bypass spots, and especially plate to grid coupling and most especially in AVC circuits causes trouble.

The heater voltage is 6.3VAC and I'm wondering why the designers used 400V or better caps here. Is this necessary because the noise spikes are considerably larger than 6.3V

Yes, switching spikes can be of much higher voltage than the normal circuit voltage, especially when there are inductances involved (which is not the case in an oven heater.)

>or is it possible that these were just handy since there were so many other 0.1mfd @ 400V caps used in other places in the radio.

Yes, very likely.

>Any comments?

Leave any yellow caps in place unless you have determined that they are in fact giving trouble.

Date: Thu, 17 Mar 2005 12:10:31 EST
From: Flowertime01@wmconnect.com

Subject: Re: [R-390] Cap Question

This is a military receiver. It has / had a logistic support system that spans the planet. As many common parts are used as possible. Do you really understand how many of your tax dollars are needed every time some engineer introduces another part into any military design. As part of the R390 to R390/A cost reduction program, all the parts would have been reviewed and common parts used. We could use lower voltage rated cap in many places in the receiver. But that a part on a drawing, parts lines of ink in parts manuals.parts laying on depot shelves. More items to get shipped wrong. The driving factors are logistic cost not electronic design. Roger KC6TRU

Date: Thu, 17 Mar 2005 12:27:41 -0500 (EST)
From: John Lawson <jpl15@panix.com>
Subject: Re: [R-390] Cap Question

The work I do (in order to have the money to buy heavy old radio gear!) is involved with the refurbishment and modification of ground support gear for military aircraft. The actual cost the electronic/mechanical work is in many cases the least of the burden on the project - what must also be considered, as Roger points out, is the logistics, the supply-chain blizzard of paperwork, the required changes to *all* the pubs and docs and drawings/illustrations associated (they must all be in a standard, prescribed format), the various calibration and maintenance procedures, nomenclature changes, and then there's the *training* issues - the responsible folks in the field need to be brought up to speed on any significant changes - operators, repair folks, cal-labs the various course syllabi need to be updated, the trainers trained.... That's why a 10-32 3/4 cad-plated Phillips pan-head screw can cost $14 each.... not that that's a *good* thing, but factor in all the costs. An R390A is just one radio - think of the costs of a battleship - every part, every fitting has it's own *coordinated* system of information and logistics, every subassembly, of every major component...

Date: Fri, 18 Mar 2005 21:19:37 -0600
From: "Barry" <N4BUQ@aol.com>
Subject: [R-390] Metallized Polyster vs Metallized Polypropolene

Can someone tell me which type of cap is preferred for applications in the R390A? Are there significant differences which would lend one better for these RF applications than the others? I have found both types with axial leads and am wondering which one to use. I think the ODs I have used before were polypropylene.

Date: Fri, 18 Mar 2005 22:44:31 -0500

From: Bob Camp <ham@cq.nu>
Subject: Re: [R-390] Metallized Polyster vs Metallized Polypropolene

Polypropylene is the preferred one of the two. They have better performance at RF. That's not to say they are great at RF, just that they are better than polyester.

Date: Sat, 19 Mar 2005 15:34:02 -0800
From: "Craig C. Heaton" <wd8kdg@worldnet.att.net>
Subject: [R-390] Filter cap rebuild pics

Just getting started on a Motorola R-390A, all of the sub-assemblies are on the bench. This unit was working (somewhat) before I brought it home. So if it never plays again, its my fault. This will be my first attempt at restoring a receiver, done several transmitters. Rebuilt a Johnson 500 this winter and now need a good set of ears. The filter caps are original, circa 1956 and I want to restuff the cans with new electrolytics. Cutting the old cans open and getting the black goop and old caps out shouldn't be a problem. THE QUESTION, what new caps will fit into the old cans??? If you have a part number I can order from Newark, Mouser, etc.

I see two new Orange Drops, (C549&C553) and a new electrolytic, C609. About the only other piece not present and accounted for is the line filter. Every other piece is original. Not looking for a museum receiver when I'm done. I just want a good working receiver, that hopefully I don't have to work on for a couple of years.Planning on changing out the paper caps, black beauties, clean the tranny,(its dirty,some roller not turning)and realign. Then its time to play HF radio, haven't had a yeahaaaaloooo AM angle music station on the air since 1984.

Date: Sat, 2 Apr 2005 13:54:57 -0800
From: "Craig C. Heaton" <wd8kdg@worldnet.att.net>
Subject: RE: [R-390] Help getting unstuck!

The worst of the caps were the Brown Beauties! Using a Sprague TO-6A, couldn't get any of these to provide a reading as to value. As far as insulation resistance, most were close to nil. Some of these had something that looked like dried brown snot on them. Good stuff to auction as Rare vintage Collins equipment on that E place. The Vitamin Qs were for the most part fine business, good values and IR. Since I had them out for inspection, it was easy to replace these while the iron was still hot. C603, all three 30uF sections read about 60uF and somewhat leaky. C606, both 47uF sections read about 75uF and leaky. Not bad for 1956 vintage, they served their country well. C103, a Pyramid from 1957 was a dead short. Stuffed that can with a new 50uF 50Vdc electrolitic cap. Last, C551 that oil bath 2uF can, it read 2.25uF and no IR. I cut that bad boy open with a

dremel tool and put a NTE-MLR205K630 (Mylar 2uF) inside. Never tested an oil paper cap before, maybe didn't need to replace C551, but didn't like the zero insulation resistance.

Was this Motorola a Saint Julians Creek special? I don't know, its a Order NO 14-PM-56-A1-51, if that adds to the conversation. All the sub-chassis have the same Order NO and are Motorola.

I've been trying a little WD-40 applied with a tooth-pick and a hair drier to free the slug. Gots lots of time to free that pesky critter up. Could leave it alone and do the best I can with the others. But I do like the idea of a root canal. Need some spare parts before surgery!! Either a good T501 or a slug will do the trick.

Date: Sat, 02 Apr 2005 21:23:39 -0500
From: Bob Camp <ham@cq.nu>
Subject: Re: [R-390] Help getting unstuck!

An ideal capacitor would pass no current at DC once it had been charged. In fact it passes no DC current at all, it just stores it up. That's another issue though. Back to insulation resistance .... So we put a DC voltage on a real capacitor and *suprise* it has leakage current. It passes some current at DC even though an ideal capacitor should not. This is simply because we can't make an ideal part. In order to decide just how good a real capacitor is we need to have a measure of how much it leaks. The leakage behaves like a resistor the easy way to describe it is as a resistor across a an ideal capacitor. The bigger this resistor the better the capacitor. So far so good ... Unfortunately there are two ways to describe a resistor. One is in ohms (zero is bad in this case) the other is in 1/ohms (conductance or Siemens). In the case of conductance zero is good. You have to be careful to be sure which your machine is calibrated in ...

Just to make things even more complex ....

The specification on capacitors is normally written in terms of megaohm microfarads. The bigger the capacitor the more it leaks. The more it leaks the lower the insulation resistance. The capacitors in question all should have insulation resistances in the hundreds of megaohms if they are working right. Anything below about 50 megohms is likely to be a defective part. This of course only applies to the parts that are not electrolytic. The electrolytic parts often are rated in leakage current. In an R-390 anything below a few milliamps is fine. A milliamp at 300 volts gives you a third of a watt in heat in the capacitor. At ten mils you are up to three watts and the capacitor can get a bit warm. The problem with leakage measurements is that they do not totally represent the situation with the capacitors. On the black beauty caps the leakage does not entirely

behave like a resistance. It goes up and down in bursts. The fancy term for this is popcorn noise. When you get a burst of noise (or current) the voltage on the capacitor drops fairly quickly in a typical R-390 circuit. This gives you an intermittent snap crackle pop noise in the background on an otherwise quiet signal. Since atmospheric noise can do the same thing it may take a while to figure out what's going on.

None of this is to suggest that you should replace otherwise good capacitors. The issue is that bad capacitors can, but don't always do cause real problems in a radio. About the only other point to make is that you do not want to replace
the paper or plastic insulated capacitors with electrolytic capacitors. The leakage levels on all of the electrolytics are *much* higher than the leakage of the plastic or paper parts. Hope that helps some.

Date: Sat, 2 Apr 2005 23:51:22 -0800
From: "Craig C. Heaton" <wd8kdg@worldnet.att.net>
Subject: RE: [R-390] Help getting unstuck!

Ok, here goes nothing, I'll do my best, and remember this is not my forte'. I bought the Sprague just for this type of fun so I'll condense the manual.

First there are two groups of caps; group ONE are electrolytic caps, then group TWO are all the others (ceramics, micas, paper, film, air, etc.). The Sprague TO-6A runs three basic test: checks the capacitance (both groups), leakage current of electrolytics, and insulation resistance of the others. I like to remove the cap and connect its leads direct to the tester, don't have to figure in the capacitance of the leads that way. Run the capacitance value test first, just about every Brown Beauty in the Motorola failed here. The tester could not determine their value.

If it is an electrolytic, the tester can apply the same dc voltage (up to 600V) the capacitor is rated at. Looking at the manual there is a nice table showing what the leakage current (uA) of a new electrolytic MIGHT be (uF vs DC working voltage). In general lower leakage is better.

Group TWO: all the others: The TO-6A tests them as two groups 50V to 200V,
200V and higher. Here, the high the insulation value the better the cap (in general). Connect them to the post, push a few buttons, and read the meter. Most of the Brown Beauties had very low insulation resistance or none (nil).

It was sort of fun connecting the old caps, testing them, and then comparing them to a new electrolytic or orange drop. Big difference, but since most of the old caps were 1956-57 vintage, someone got there

money's worth. Nothing last forever. The object of this exercise is to end up with a receiver that I might not have to put on the repair bench for several years.

As to my use of nil in the first post, I've never tested an oil filled cap before and didn't have an exact replacement to see how it would test. I don't think C551, the 2uF oil-filled cap when new would have zero insulation resistance. Back to paragraph one, this is not my forte'. Just having fun and will keep it that way. Craig,

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Date: Sun, 3 Apr 2005 15:50:32 -0400
From: "Joel Richey" <richey2@mindspring.com>
Subject: [R-390] Cap leakage

The real fact-of-the matter- is capacitors made today are so much better the the ones made in the 50's-60's and 70's that they approach the ideal cap, and when people argue that there is no reason to replace a cap unless its bad is foolish, when I rebuild a unit I, as a matter of fact replace every cap, the ESR, etc is way superior. To not replace a wax, Paper, black bueaty or brown beauty just becaus you think it isn't bad is penny wise and dollar foolish. Quality caps are cheap and when ckts were designed with perfect caps why not provided them with em. Thats my 2 cents..

Date: Sun, 3 Apr 2005 12:55:17 -0700
From: "Craig C. Heaton" <wd8kdg@worldnet.att.net>
Subject: RE: [R-390] Cap leakage

Guess there are different sides of the fence in which to stand, or sit upon! If the piece of equipment is a real beauty, museum quality. I can see trying to keep it all original down to the last screw, washer, and nut. The one and only R-390A that I have is not museum quality and hasn't been kept in the best of conditions. All the big pieces are there and with my limited knowledge, I think all of sub-chassis are original. Just want a dependable receiver that I shouldn't have to work on for a while when I'm finished. In what was my line of work we called it, "on stream time". Kind of use to seeing numbers better than 99.5% on stream. So I guess I'm on the capacitor replacers side of the fence. Rather spend the pennys on caps and not have to search for hard to find big dollar pieces later.

Date: Sun, 3 Apr 2005 16:21:58 EDT
From: DJED1@aol.com
Subject: Re: [R-390] Cap leakage

I've opted on the side of not touching the radio unless necessary. It's had an easy life- I bought it in very good condition in 1973, and it has seen only light use since then. I don't run it 24/7 and for quite a few years

didn't run it at all. I've done only necessary maintenance, which has comprised changing out a couple of tubes, the microswitch, and the original Progressitron PTO (it developed a warble). It has the metal jacketed vitamin Q capacitors, and those have lasted better than most, from what I've heard on the board, so I'm not too concerned that I've got a bunch of leaky caps. So I'd rather stick with what I've got than to go mucking around the insides changing components. To each his own...

Date: Sun, 03 Apr 2005 18:30:43 -0400
From: Bob Camp <ham@cq.nu>
Subject: Re: [R-390] Cap leakage

As far as I can see the metal jacket and the yellow jacket capacitors you see in the R390 are not in the same class as the "good old" black beauty capacitors. I have not seen a consistent problem with either one. The only thing I have ever seen a problem with are the black or brown body epoxy coated paper dielectric capacitors. The exception of course are those yellow jacketed capacitors that have been hit with a soldering iron. They don't survive that kind of treatment as well as the other parts ...

Date: Sun, 03 Apr 2005 18:38:32 -0400
From: Bob Camp <ham@cq.nu>
Subject: Re: [R-390] Cap Leakage

There are a number of posts here in the archives on insulation resistance. Some of them relate to the fact that in order to fully know what is going on with the capacitors you need to put the full rated voltage (or close to it) on the caps. A megger (high voltage giga ohm meter) is often mentioned as the instrument of choice here. Not to ignite a replay of previous debates on capacitors but I have never had a paper / black (or brown) beauty capacitor pass at any voltage ... It should be noted that others apparently have had *very* different experiences with these capacitors.

Date: Sun, 3 Apr 2005 20:22:19 -0600
From: Tom Norris <r390a@bellsouth.net>
Subject: [R-390] When Capacitors Go Bad

No leather jackets, no switchblades, no pack of Luckies rolled up in their shirt sleeves. They just go to pieces --

The first pic is one side of a normal looking BBOD -
http://www.fernblatt.net/miscpics/bb1.jpg

The other side tells the true story --
http://www.fernblatt.net/miscpics/bb2.jpg

I forget what I removed this from, or if I'd even posted it before. Tom NU4G

Date: Mon, 2 May 2005 11:45:25 -0700 (PDT)
From: Jack Sullivan <jsullivan10512000@yahoo.com>
Subject: [R-390] Question to post

My Collins R390 (not "A" version), on I.F. deck, has two top chassis mounted OIL FILLED condensors, side by side, 1 mf-400 volts each, hooked in parallel, giving 2 mf 400 volts. They are a coupling to AGC circuit. Why in the world did Collins design two such condensors to be wired in parallel, rather than just installing one 2 mf-400 v. condensor, was it, perhaps because a larger 2 mf. wouldn't fit in spot on chassis top, or could it have been that they just didn't have available to them at time 2 mf cond. needed? Best, Jack

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Date: Mon, 02 May 2005 17:52:53 -0400
From: Dave or Debbie Metz <dmetz@ntelos.net>
Subject: Re: [R-390] Question to post

Not sure but here's my thought. These caps are non polarity and even today, non-polarized caps seem a bit big compared to their brethren electrolytics. Trying to think about 1950 manufacturing gives me pause that Collins couldn't get a 2mf cap either easily or as cheap as two 1mf caps as you suggest. I had one go bad and replaced both of them with about 1.5mf total and it works great.

Date: Mon, 02 May 2005 18:14:46 -0400
From: Barry Hauser <barry@hausernet.com>
Subject: Re: [R-390] Question to post

The Scott RCH receivers have four stud-mount oil filled 4 mfd 400v capacitors right in a row on the chassis. They're metal cans but the can is isolated from the stud so not (necessarily) grounded. They have two contacts on their bases -- non-polarized. Not easy to find equivalent tubulars so have to be replaced with multiple caps in parallel, I guess. These caps last a long long time, but they have insulator material between the body and the stud and if struck or "leaned on", can break and leak their mojo bug juice. (Probably PCB-laden oil) I've got one which was broken as delivered and one of the other four hanging by a thread. I've seen Orange Drops listed as high as 2 mfd. but not often. I believe you can put electrolytics in series to make a non-polarized combo - or buy non-polarized electrolytics used in speaker crossovers, but wouldn't assume they have the right parameters or available in high enough voltage ratings.

Date: Mon, 2 May 2005 16:10:01 -0700 (PDT)
From: Jack Sullivan <jsullivan10512000@yahoo.com>
Subject: [R-390] Post to list

On R-390 (not "A" version), I am about to replace most all paper condensors (we now call them capacitors, of course), probably with polyprop. Orange Drops. I see that these types of condensors in this set are metal covered, and look to be of very high quality (military spec., I am sure, is reason for that). Are these metal covered, numerous ones are .01, .1, .22, 1. mf, really paper caps, as I suspect? I have replaced a gazillion paper caps in civilian radios, but have no experience with military radios/electronics, and have never seen metal covered ones like this before. Anyone know much about the quality of these metal covered condensors, how smart it is to replace them, etc.? I will replace, too, any electrolytics that I find not testing well (the 50 mf., 50 volt unit will be first to replace, as it is shot, for sure, as tested), while two 10 mf are in great shape, and I will leave them in place.

Date: Mon, 2 May 2005 19:24:50 EDT
From: Llgpt@aol.com
Subject: Re: [R-390] Post to list

On a R-390/URR. there isn't a capacitor problem as there is in the cost reduced R-390A/URR. (See how simple that is for the "NON A ") challenged??????? Unless you have aprticular problem with capacitors "actually" leaking on a
R-390/URR, leave them alone. YMMV and may the force be with you.

Date: Mon, 02 May 2005 19:49:07 -0400
From: Bob Camp <ham@cq.nu>
Subject: Re: [R-390] Post to list

I seem to be the poster child for changing capacitors around here. The only parts I have seen with a problem are epoxy coated parts. I have not seen problems with the metal jacketed parts or with the yellow mylar covered parts. It's easy enough to check one or two capacitors for leakage resistance and see if they are in specification or not. A simple test is to put about 50 or 100 volts on the capacitor and see how much current it pulls at DC. The specification on most of these parts is in the several hundred mega ohm region. A leakage current in the sub micro amp region would indicate a capacitor that is in specification. Changing out parts that are working ok is not a necessary thing. One thing to be careful of is dirty parts. A part with a bunch of crud on it will leak weather it's a capacitor or not.

Date: Mon, 02 May 2005 17:35:32 -0700

From: "Kenneth G. Gordon" <kgordon@moscow.com>
Subject: Re: [R-390] Post to list

The metal covered capacitors with the glass ends are practically indestructible. Leave those alone. You may be able to read Sprague on some of them.

Date: Mon, 2 May 2005 20:08:45 -0500
From: "Cecil Acuff" <chacuff@cableone.net>
Subject: Re: [R-390] Post to list

My experience, though limited, with the R-390 and the info I have heard from others is that cap replacement is not usually needed nor recommended. The failure rate of the caps in the R-390 is orders of magnitude lower than that of the R-390A. Even the filter caps don't seem to fail. (because they're of a different design) I have tested those filters and various electrolytic type caps and found them to be well within specs in the last two I have had through the shop...one on the bench now. I would suggest you do a spot check of several that are easy to get to and make your judgment from there. Make sure you check them at their rated voltage. You will find it very difficult fitting Orange Drops into the places they have put the high quality bypass and coupling caps...many in snap in stainless steel brackets... I would be more concerned about out of spec resistors... especially under the regulators, rectifiers and in various places in the audio deck. Beyond that they don't require much!

Date: Tue, 03 May 2005 10:10:43 -0400
From: Roy Morgan <roy.morgan@nist.gov>
Subject: Re: [R-390] Post to list: Metal cased caps.

>... ...condensors in this set are metal covered, ...

Do not replace them (unless one of them is actually bad). Those are metal cased, glass insulated, foil with paper and oil dielectric caps and normally last forever. (No doubt some folks on the list will tell about how they found leaky ones.) If you do replace them, send them to me. I'll put them back into my
R-390's where I take out the real troublemakers!

> Are these metal covered, numerous ones are .01, .1, .22, 1. mf, really paper caps, as I suspect?

Yes, they are paper-foil-oil caps. One brand you may have heard of is "Vitamin Q" from Sprague. Sometimes they have a clear plastic tube over them, or a yellow covering. The giveaway is the metal case, sealed with solder, and the glass insulating end piece.

> I have replaced a gazillion paper caps in civilian radios,

That's good. they needed it.

>Anyone know much about the quality of these metal covered condensors,

The quality is superb.

>how smart it is to replace them,

Not smart at all. Don't do it.

Date: Fri, 6 May 2005 11:02:45 -0700 (PDT)
From: Jack Sullivan <jsullivan10512000@yahoo.com>
Subject: [R-390] Capacitors in R390 (non "A") vs those in R390A

I have noted the type/brand of condensors (we now call them capacitors) in R390 and in R390A, and I have been reading original data from manufacturers of those condensors, mostly from Spraque,that was in MA at the time. Clearly, a huge difference in caps between original R390 and later cheapened up "A" version (I will probably hear nasty words from you "A" lovers, but "A" version was indeed cheapened up, for that was objective of the revamp).

However, some improvements were made in "A" version, as you probably already know. Anyway, the caps used in the original R390 were about the best available at the time, many of them being Vitamin Q type, with insulation resistance of 200,000 to 300,000 megs. Too bad that they didn't keep using those vastly superior caps in "A" version.

Now, after 50 years, leakage is common with most paper caps, but the super caps in original R390 seem to still be doing well, based on my tests anyway. Even the oil filled electrolytics in R390 are in great shape, if my set is any indication.

However, I did find the 50 mf, 50 volt small elect. one to be bad, but that is no problem to replace. Nice to put new one in old case, so it all looks as it originally did. Hope this all doesn't sound like I know it all. I am just trying to share what I have been testing and reading, regarding caps in R390/R390A.

Date: Fri, 6 May 2005 14:02:14 -0500
From: "Cecil Acuff" <chacuff@cableone.net>
Subject: Re: [R-390] Capacitors in R390 (non "A") vs those in R390A

I agree with you Jack....after working on both the "A" is very notably a cost reduced version....a great radio but not built using the quality of components found in the R-390 for sure.

Date: Mon, 23 May 2005 20:09:54 -0500
From: bw <ba.williams@charter.net>
Subject: Re: [R-390] R-390 "deadly components"

Uh, what problems do the A's have? Maybe I should go check mine???

Date: Mon, 23 May 2005 20:26:18 -0500
From: "Cecil Acuff" <chacuff@cableone.net>
Subject: Re: [R-390] R-390 "deadly components"

Paper caps mostly....brown or black don't matter!

Date: Mon, 23 May 2005 21:57:45 EDT
From: Flowertime01@wmconnect.com
Subject: Re: [R-390] R-390 "deadly components"

Brown beauties.

A cap in the mechanical filter circuit that fails and then kills the mechanical filters.
If your post is not in Jest, get over to the archives, and get the real list.

Date: Mon, 23 May 2005 20:59:48 -0500
From: Tom Norris <r390a@bellsouth.net>
Subject: [R-390] The Nolan Lee Memorial 390A Capacitor List

Anyone have a better list?

Nolan's R-390A/URR Master Capacitor List
Revision 0.2 BETA (5/6/99) <snip>

Date: Mon, 23 May 2005 22:00:12 -0500
From: bw <ba.williams@charter.net>
Subject: Re: [R-390] The Nolan Lee Memorial 390A Capacitor List

There is always the 'Dave in Birmingham" list for the cap packages that he put together. I have the list somewhere and never thought to compare the two. Maybe I'll check it out and OCR it for the list if interesting.

Date: Mon, 23 May 2005 20:04:30 -0700
From: "Leigh Sedgwick" <bipi@comcast.net>
Subject: Re: [R-390] R-390 "deadly components"

Jeez Roger, that is a little harsh! BTW, the word is cheap, even if I don't agree with your choice of words. I rather think of the R390A as a design solution to make the radio easier and less expensive to repair, which I'm sure was an overriding design requirement. There may be some performance differences, but I like to think the "A" model is more than adequate! Just my humble opinion..

Date: Mon, 23 May 2005 23:27:50 -0400
From: "ROBERT YOUNG" <youngbob53@msn.com>
Subject: Re: [R-390] R-390 "deadly components"

I'm mostly a medium wave DXer and had been told the mechanical filters in the A were superior than the filters in the non-A at least for the BCB band that the peaks of the curves were flatter thus more intelligible in the narrow positions which you need to DX the foreign splits, what's the consensus around here (I don't have either yet)

Date: Tue, 24 May 2005 00:44:16 -0400
From: "Drew Papanek" <drewmaster813@hotmail.com>
Subject: [R-390] The Nolan Lee Memorial 390A Capacitor List

Nolan Lee's R-390A capacitor list is all-comprehensive, perhaps too comprehensive for those of us who wish only to replace those pesky failure-prone paper and electrolytic caps. Shortly after Nolan compiled his list , Wei-i Li released a list comprising just the paper and electrolytics. Much more information on capacitor replacement can be found in his "Pearls of Wisdom", a distillation of postings gleaned from this forum over the years. Goto r-390a.net . Click on references, pearls of wisdom and be amazed. Be very amazed. So without further ado I present for your edification Wei-i's posting:

Drew [Begin old post}

Date: Thu, 5 Aug 1999 08:54:24 -0700 (PDT)
From: W Li <wli@u.washington.edu>
Subject: [R-390] Re: Recap shopping list

I had a chance to go over Nolan's R-390A cap list, and rehacked it to reflect my needs. This is only a working list, so let me know of errors. A shopping list for any recap kit would include:

- ----------

(13) 0.1 ufd
C256, C309, C504, C505, C517, C521, C528, C531, C536, C538, C543, C547, C548,

(7) 0.033 ufd

C275, C529, C533, C534, C541, C545, C602

(7) 0.01 ufd
C549, C553, C601, C604, C605, C607, C608

(I'd go with the SBE 716P 600v OD's at the outset, seeing as how recapping
is not a trivial project)

(3) 30 ufd 300 v electrolytic C603
(2) 47 ufd 300 v electrolytic C606

(Sticking new electrolytics in an empty octal relay case as Tom Norris did, worked out swell for me)

Finally, only one needed of:

0.047 ufd 100v C227
8 ufd 30v tantalum electrolytic C609
50 ufd 50 v electrolytic C103
2 ufd 500v C551 oil-filled paper
0.22 ufd 100v C101
- ----------
Obviously C553 and C549, and the AF deck electrolytics C603 and C606 take
precedence in any recap project, as stressed in earlier posts. Now here is a chance for AES to make up a 37 item kit (just kidding)..... Thanks, W. Li
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Date: Tue, 24 May 2005 01:05:52 EDT
From: ToddRoberts2001@aol.com
Subject: Re: [R-390] The Nolan Lee Memorial 390A Capacitor List

Thanks for showing Nolan's R-390A capacitor list again! It is nice to have a listing of the silver micas used also. The silver micas are prone to trouble with age also. I have seen more than a few go bad inside the RF Deck transformers. The symptoms are reduced sensitivity across an RF band range and an inability to peak one or more of the RF transformer slugs. If a particular slug will not peak one of the RF transformers usually this is a good indicator that the silver mica inside has gone open or short. This will likely cause the sensitivity to drop quite a bit across that band range. Usually the silver micas are easy to replace once you take the cover off the RF transformer. It would be a shame to throw away a perfectly good RF Deck transformer when all it needs is a new silver mica cap inside. 73 Todd WD4NGG.

Date: Mon, 23 May 2005 22:42:42 -0700

From: Dan Arney <hankarn@pacbell.net>
Subject: Re: [R-390] The Nolan Lee Memorial 390A Capacitor List

I bought several kits from Dave and I think I bought 15 kits from Walter
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Date: Tue, 24 May 2005 09:36:21 -0700
From: "David Wise" <David_Wise@Phoenix.com>
Subject: RE: [R-390] R-390 "deadly components"

The R-390A parts list specifies C553 as part number 96P1030354, which is the same expensive, hermetically-sealed "Vitamin Q" grade that earns justifiable praise in the R-390. Yet it's marked for immediate termination in the 'A. Rationality or religion? Replace all infidel caps,
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Date: Sun, 26 Jun 2005 15:52:06 -0700
From: "Dennis L. Wade" <dwade@pacbell.net>
Subject: [R-390] Re capping an IF Deck

I spent some quality time with my Motorola '390A yesterday and this afternoon. I actually got the cleaned and recapped RF deck back in the frame and everything is synced up nicely now. Some may remember my last post as being PTO woes...I'll be posting a follow up to that saga just as soon as I finish eating my crow. :/ I did learn some good lessons though. In the meantime however, I have now pulled the IF deck in preparation for recapping. This is an EAC unit, the only non-MOTO module in my rig. This one was factory(?) mod-ed to use a product detector module mounted behind the function switch. A new connector was added to feed the new module.

I mention this because it appears that at least some of the recapping may have been done for me. I find no "brown beauties" in this deck at all. In (some of) their place have been installed "Westcap" units, however I can't tell if they are still paper units or not. They do appear to be in good physical shape. These are in places such as C-531, C-549 and C-533. My inclination is not to replace these. Other caps are Aerovox units that are probably wax paper jobs. These live in places such as: C-528, C-529 and C-521 among others. Some of these seem to be in good physical condition, but some have deformed from their original round shape to oval in some cases. Which if any of these should I replace? My general feeling is that knowing my (lack of) experience I don't want to go into places in this crowded deck I don't need to be.

The only symptom I think I have, at the moment in this radio, is low AGC voltage. AGC cap. The replacement unit I have has rather short leads. What is the best physical arrangement for putting this guy in. Lift one lead from the old cap and put it across the old? Advice would be

appreciated. Thanks all in advance for your collective wisdom
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Date: Sun, 26 Jun 2005 18:29:26 -0700 (PDT)
From: Joe Foley <redmenaced@yahoo.com>
Subject: Re: [R-390] Re capping an IF Deck

If this is a '67 EAC the chances of it needing any caps replaced are slim. Unless it has seen abuse or damage of some sort. The only cap that should be replaced without consideration on the IF deck of a '67 EAC is the one that protects the mechanical filters.

Date: Sun, 26 Jun 2005 21:29:55 EDT
From: Flowertime01@wmconnect.com
Subject: Re: [R-390] Re capping an IF Deck

There are variations of four choices for the AGC cap.
1. Do nothing or similar more nothing.

2. The slow 2uf AGC cap can be replaced in the can like rebuilding power filter caps. Not more or less messy than power filter caps.
3. Add a new cap under the deck. Leave or remove the above deck can. C551

4. Install a socket in the deck hole and mount the cap in a crystal oven can and plug that into the new socket. An 8 pin octal socket will mount nicely and the
other C548 cap will also fit in the oven can.

Along with these rebuilds it is suggested that C548 be increased from 0.1 uf to 1.0 uf. Pushing C548 up into the new can fits nice. After recapping the IF deck, there is much more space under the deck. Those brown tubes were "big" in their own way.

It is C553 that keeps the 1st IF B+ out of the crystal filters. Inspect this cap to see if it looks like a 600 volt rated cap. You may want to replace this cap if it even looks like less that a stellar quality item in your deck. Some time now for peace of mind over the next 50 years is a small price and some quality time with your receiver.

There are ranges of paranoia for your IF deck. Real severe leaves you unwilling to even apply power to your receiver. Not real common but known to occur. Less severe cases accept nothing less than a real full rebuild with nothing less than Orange Drops. Some will not even accept a self-build and require the work be performed by a real "professional restorer." Having a radio is supposed to bring you joy and not anxiety and misery. Lesser degrees of paranoia will let you install almost any current

good brand of cap in the deck to get the brown tubes out and keep the receiver receiving.

Real cavalier owners will run the receivers until the smoke escapes and thenonly replace the minimum carbon needed to return the receiver to operation.

As with all preventive maintenance the objective is to put in the minimum up front work to avoid even more work later. So changing caps is good.

Only the brown and black tube caps in the R390/A are known to be more likely bad than good today given there age. Also for ever bad cap found some will post here that there old caps are still hanging in and working good.

As you do not have the brown tubes, your deck either never had them or has been rebuilt. A look at the solder will likely provide some clue as to originality. Some fried wire at the terminals is a clue someone got there with a solder iron after the wire had aged many years. You will likely be OK with what is in the deck. Do inspect the cap to the filters, C553, you may want a good 600 volt cap in there. Something you have some confidence in. An orange drop is good. A Radio Shack part not so good.

Other than that you just need to reach a comfort level you can be happy with. There are reasons to change lots of the caps. Some value changes have been offered over the years to improve the frequency response mostly in the audio deck.

Changing C553 to a break down voltage of 600VDC to protect the mechanical filters.

Changing C548 0.1μF AGC to 1.0μF For less AGC pumping are a few.

Caps like resistors have their own popcorn noise. Parts have been hunted down and changed out just to get a better receiver noise floor. As you have no brown tubes in your deck, you have no known issue driving you to make any changes. Now you get to make choices based on satisfaction and enjoyment. Enjoy Roger KC6TRU

Date: Sun, 26 Jun 2005 19:31:48 -0700
From: "Dennis L. Wade" <dwade@pacbell.net>
Subject: Re: [R-390] Re capping an IF Deck

Yep, you're right Joe. Its an EAC deck from '67. Funny how I never checked that detail before. So, the AGC cap may be the only one I do (well, and C553). Wonder if I can just float that AGC cap in there, with leads

appropriately
insulated of course.....

Date: Mon, 27 Jun 2005 08:03:57 -0400
From: "Tim Shoppa" <tshoppa@wmata.com>
Subject: Re: [R-390] Re capping an IF Deck

Those westcaps are very similar to Sprague "Vitamin Q"'s. Paper-and-oil capacitor that's hermetically sealed in a can. One of my EAC IF decks has a mix of brown beauties and Westcaps and Aerovox caps. I think they're almost all original... my guess is that they are arranged according to allowable leakage current. My gut feeling is that the Vitamin Q's/Westcaps are superior to the others but that they do go leaky over time. And they probably were installed in
the locations most sensitive to leakage to begin with. I say that if you're doing a mass replacement of everything else, you oughta do these too just to save the effort of going back in later. The other EAC IF deck I have is all brown beauties. So maybe the ones with the others truly are replacements done by the military. They don't look like re-work but then again it was done decades ago...

> Other caps are Aerovox units that are probably wax paper jobs.....

I thought that they originally came oval? (And my head was always bald too...) New yellow wax paper caps are certainly available in oval. Handy when there is low chassis clearance with a PCB.

Date: Mon, 27 Jun 2005 19:47:08 -0400
From: "Drew Papanek" <drewmaster813@hotmail.com>
Subject: [R-390] C-551 Replacement

Another method for replacement of C551, the oil-filled ACG can capacitor: I removed the leads running to the can's terminals under the chassis. I used a Cornell-Dubilier (CDE) DME series (available from Mouser) mylar cap rated 2.2 uF at 400 volts. I cut the new cap's leads to about 1/4 inch and bent them into hooks. The new cap was secured with RTV to the divider running lengthwise under the chassis on the side of the divider facing the old C551. The leads which formely wento the old C551's terminals were wrapped and soldered to the hooks formed into the new C511's leads. The old C551 remains bolted to the IF chassis but is not electrically connected.

C548 was formerly connected from one of the old C551's terminals to ground. A new C551 (0.1 uf, 600 volt Cornell-Dubilier DME) was connected right at the socket for V506, between a convenient ground terminal and the grid terminal for V506A. The new location is different

mechanically, but identical electrically. The new cap's very small size makes the relocation practical.

A sharpie marker was used to add a note about relocation underneath the chassis to make matters simpler for the next poor unsuspecting soul who works on the radio.

Date: Tue, 05 Jul 2005 05:32:28 -0400
From: shoppa_r390a@trailing-edge.com (Tim Shoppa)
Subject: [R-390] My recapping measurements

OK, I put Orange Drops in for every 0.01 - 0.1 uF cap in my yellow-striper. I admit it. It had a mix of makers (Stewart-Warner RF deck, EAC IF deck, Collins AF deck) and a mix of capacitors in it when I found it. The RF deck had brown beauties, the IF deck was a mix of Aerovox yellow caps, metal Westcaps, and brown beauties, and the AF deck was yellow caps (Sprague and Aerovox) and Sprague Vitamin Q's and a few brown beauties. All looked to be original or very-consistently-wired replacements done decades ago. I made an impromptu leakage tester out of 20 9-volts in series and a microammeter.

Every brown beauty had large leakage (milliamps in some cases, always at least 50 or 100 microamps).

Every Vitamin Q and Westcap and Aerovox cap had zero to no measurable leakage. One of the Sprague yellow caps was a dead short. I think I would've been able to measure a microamp or two if it had been there (the meter is 50microamp full scale).

The canned electrolytics on the AF deck did pretty well, leakages in the hundreds of microamps. I had expected them to do worse. I was surprised that between pin #1 and pin #7 on the 45mfd two-section electolytic that there was several milliamps flowing there. My understanding is that there's no capacitor/no connection there!

My conclusion: replacing the brown beauties was absolutely the right thing to do, even though they didn't have any obvious cracks or similar. The westcaps and vitamin Q's might have held up another 40 (or more!) years, but who knows. Incidentally, every un-recapped IF deck I can recall seeing (hamfests etc.) seems to have had a Vitamin Q or Westcap in the IF deck as the coupling capacitor to the mecahnical filters. Has anyone actually seen a brown beauty in that position? I get the impression that the makers of the IF decks knew they needed high-quality caps in some positions and that they could get away with lower-quality caps (brown beauties) in others. (How they would've known at the time that the brown beauties would eventually develop leakage, I don't know.) Of course it's

possible that the depots replaced all brown beauties in critical positions long before I ever saw the guts of an IF deck.

Date: Wed, 13 Jul 2005 21:17:29 EDT
From: Flowertime01@wmconnect.com
Subject: Re: [R-390] C553 ever a brown beauty?

Barry says I got the number wrong. It should be C553. I would never bet on what you will or will not find in a receiver. Never say never. OK so C553 my not be one of the brown ones. The issue is to inspect the critter and get something better than the original in there. The cap value is OK. It is the voltage rating that fails.New caps being smaller than old caps, a 600 volt item fits very nice. My cap is long past original, and I do not know for sure what was ever installed into any receiver. My lack of memory is causing me more problems than you want to know about. Maybe my speculation on the color and brand is not accurate. Chuck Rippel did not write for years about that cap failing and killing the filters. What ever the original one in there was it was known to fail and kill filters for more than one person. We think of most Sprague Vitamin Q's or Westcaps as being good caps and not needing replacement. But when someone ask where to start, I think some insurance for had to get expensive mechanical filters is a good first step to check that cap. I am not saying old men should be followed blindly, but I find it hard not to respect Dave Medley and Chuck Ripple even if I can't type their names correctly.

Date: Fri, 26 Aug 2005 11:28:05 -0400
From: Roy Morgan <roy.morgan@nist.gov>
Subject: Re: [R-390] Some questions?

>I have been changing the brown beauties out in the R-390A. ... applying variable DC to one >side of the capacitor and with the DC milliamp meter checking the current through the >capacitor. Is this a good indication of the leakiness?

Yes, indeed. It's a fine indication. A more sensitive method is to use a DMM instead of your milliamp meter, set to voltage. It likely has a 10 meg-ohm input resistance so a ten volt indication is one microampere. If your caps are leaking milliamps at rated voltage or less, they are VERY leaky.

Date: Fri, 26 Aug 2005 17:10:33 -0400
From: shoppa_r390a@trailing-edge.com (Tim Shoppa)
Subject: Re: [R-390] Some questions?

> applying variable DC to one side of the capacitor and with the DC milliamp
> meter checking the current through the capacitor.....

Well, a mA of leakiness at 200V is way more than spec (that's equivalent to a 200K resistor in parallel) so I think you'd like something sensitive to the μA level. Many of the brown beauties are installed in places where leakiness is almost a complete non-issue. For example, the bypasses on the crystal oven on the RF deck, or the bypass on the IF deck for the ballast tube chain. If the capacitor was so leaky that it was like a 1K resistor then it wouldn't matter in those applications. In other places, where it's a screen bypass or B+ bypass, a mA of leak will substantially disturb the intended operation of the circuit (although the radio will probably seem to work fine still.) Because the brown beauties are installed in rather non-critical areas, you might want to check out the capacitors that usually are Vitamin Q's/Westcap hermetically-sealed-cans as well for leakage. In some of these circuits a μA of leakage might be too much, so upgrading your test scheme to be more sensitive would be necessary before getting to these.

Date: Sun, 4 Sep 2005 13:02:19 -0400
From: roy.morgan@nist.gov
Subject: Re: [R-390] Brown Beauty voltage rating?

I think you are right. but I am not sure. There are military cap marking tables on line. See:http://www.pmel.org/HandBook/HBpage26.htm

This site has a LOT of diffent radio-related standards:
http://www.wiktel.com/standards/caps are at:
http://www.wiktel.com/standards/capa.htm
(but not the tubular cap ones.)

Go here for a variety of tips and useful info:
http://www.gbronline.com/radioguy/tips.htm
especially oriented to antique domestic radio restoration.

Buy a color code calculator (three bands only) for two bucks at:
http://www.physlink.com/estore/cart/ColorCodeCalculator.cfm?SID=37

This page decodes the MIL cap code such as: "CM 15 B D 332 K N 3"
(The R-388 manual may contain such a code for the caps.)
http://xtronics.com/kits/ccode.htm

A calculator for modern dipped tantalum caps is at:
http://www.csgnetwork.com/capcctantcalc.html along with a long list of other calculators anc converters.

Lots of good info is at:
http://www.qsl.net/wa7zcz/area2/t_of_c.html and on page 73 is EIA and

MILITARY Color Codes For Resistors and Capacitors:
http://www.qsl.net/wa7zcz/area2/page73.html
This page mentions MILITARY STANDARD MIL-R-11E and if you find that one you may have the right info from the source.

Date: Sun, 12 Mar 2006 13:12:57 -0500
From: shoppa_r390a@trailing-edge.com (Tim Shoppa)
Subject: Re: [R-390] VFO squirreliness solved FOR GOOD

<snip>..... Was C553 a BBOD? The IF decks I've owned had BBOD's in a lot of not-so-critical-for-leakage places (e.g. screen and filament bypasses) but better quality metal cans - Vitamin Q's or Westcaps - at the filters.

Date: Sun, 12 Mar 2006 15:19:15 EST
From: DJED1@aol.com
Subject: Re: [R-390] VFO squirreliness solved FOR GOOD

Re: was C553 a BBOD? No, it was a glass and metal capacitor. I checked it after pulling it out by putting 500V thru a microammeter into the cap. Not even one microamp of leakage. I checked a couple of BBOD I had laying around and they leaked about 80 microamps. But now I've got a 600V cap instead of a 300V one. Easier than finding a 4 Kc filter these days.

Date: Wed, 03 May 2006 10:07:52 -0400
From: JMILLER1706@cfl.rr.com
Subject: Re: [R-390] More C709 info

It does not surprise me that a mica capacitor could fail in the 390a. I have had 3-4 fail in a SW model. Several have failed in the IF and Mixer cans, causing poor performance on some bands and inability to peak the coils. Whether the failure is an open or a leak I don't care, they just fail. Replacing them with moden mmica caps is the cure (I get mine from Mouser, 5% is just fine). They tend to be more prone to failure if they are across an inductor that in in a plate circuit carrying B+ to a tube. Maybe the constant B+ surges during power on over the radio's lifetime gradually tear down the caps. So when I find a filure, I replace it with one that has a next higher voltage rating than the original. Ditto for numerous .005 bypass caps, especially those on screen or plate lines to tubes (again the breakdowns caused by constant HV). When in doubt replace them. <snip>

Date: Tue, 9 May 2006 12:37:21 -0400
From: "James A. (Andy) Moorer" <jamminpower@earthlink.net>
Subject: Re: [R-390] Ceramic .01 bypss buy

The short answer is that it depends on what they are used for.

If they are just for power supply bypass, then it won't make much difference what dielectric they are. Of course, low-inductance caps (like ceramics or high-frequency polystyrene) need to be used in the RF sections, but for IF and AF, just about anything will work and nobody will know the difference. All you really want there is reliability.

For interstage coupling, it is a different matter. Different dielectrics can give the capacitor nonlinear behavior. This is why engineers really like mica and polystyrene and a few others for high-frequency coupling.

Ceramics with NPO dielectric also seem to be pretty linear (I haven't done a definitive test - this is anecdotal). Mind you, in the entire RF section, the signals are pretty small, so one could argue that no amount of nonlinearity in the caps could make a difference.

In the IF and AF sections, the signals can get to be several volts with hundreds of volts of DC bias, so nonlinearities can make a difference, albeit a small one. The only place I have actualy heard a difference in capacitors is in interstage coupling of audiophile amplifiers. With a good set of speakers or headphones, you can discern a slight difference among capacitors.

Date: Tue, 9 May 2006 09:43:44 -0700
From: "David Wise" <David_Wise@Phoenix.com>
Subject: RE: [R-390] Ceramic .01 bypss buy

> Or: why did Art not use ceramics to begin with?

They didn't exist / weren't reliable / were too expensive.
Ceramic caps were an emerging technology at that time.

Date: Tue, 9 May 2006 12:22:27 -0500
From: "Les Locklear" <leslocklear@cableone.net>
Subject: Re: [R-390] Ceramic .01 bypss buy

In a Hammarlund SP-600, the cap of choice is the ceramic, especially inside the turret assemble. Yes indeed, it is a silly question. Art never chose what type of capacitors they (Collins) used, the engineers did.

Date: Tue, 09 May 2006 13:27:58 -0400
From: "Tim Shoppa" <tshoppa@wmata.com>
Subject: RE: [R-390] Ceramic .01 bypss buy

But 0.005 ceramic disks were used extensively in the RF deck and occasionally elsewhere. The 0.01's sprinkled through the IF deck aren't

conceptually in a different ballpark. I think that time has proven that the disks are generally more reliable in bypass applications (at least they don't fail in a leaky way most of the time like the BBOD's.)

And then there's that funny sandwich of a bunch of ceramics in parallel in the PTO bypass. I think the Y2K schematic shows these as a single 0.005 but I have never disassembled a sandwich yet. And elsewhere in the PTO there's ceramic disks around the thermostat (although you could easily argue that is definitely the WRONG place to put wax capacitors.) Other thermostats in the radio use BBOD's (these are quite definitely NOT CRITICAL usages, only ever a few volts across them and awful leakage will never ever matter.)

The 0.1 bypasses and the similar and bigger stuff in the audio deck, I can certainly see why film/wax capacitors would be used there instead of ceramics. Even modern ceramics would be completely inappropriate. I would be willing to believe that different folks/divisions designed different parts of the radio and they used what they were familiar with instead of all working from a single master "preferred component" plan. Even today for a few hundred volt cap I think the 0.005/0.01 line is an appropriate dividing line between ceramics and film caps.

Date: Tue, 9 May 2006 21:53:32 -0700 (PDT)
From: Perry Sandeen <sandeenpa@yahoo.com>
Subject: [R-390] Amplification of .01 cap choice

I chose the .01 ceramics for two reasons. One is that is what Hammarlund used them in the later models to replace the .01's and .022 BBOD's. Secondly Chuck Ripple said in one of the Pearl's post to use .01's on 455Khz and above and film types on the audio. I figured he knew what he was talking about. One reason not to use ceramics for audio bypass applications is that they will "sing" from the audio amplitude changes on the B+, not a desirable characteristic to have in a receiver. One thing I learned while working at Hallicrafters in the mid 60's when they were making ECM equipment was that as long as the part had been mil-certified, that the bean counters made sure that A) they used whatever was cheapest or B) what they had on hand or were using in other products to achieve volume pricing.

Date: Tue, 30 May 2006 20:49:02 -0700 (PDT)
From: Perry Sandeen <sandeenpa@yahoo.com>
Subject: [R-390] .01 caps for sale

I bought a large lot of .01 Mfd. + 10 % 630Vdc Metalized Polyester Film capacitors. The brand is MEI and the P/N is MEF630K103B10. They have radial leads. The size is about 1/2 inch long, 3/8 inch high and

about 1/4 inch thick. No other info. They are certainly smaller than the BBOD's. I have 500 excess to my needs. I will offer them to the list on the following basis only to US addresses because of customs issues. First, to let everyone on the list read their email and get a chance to buy I will take email requests ONLY AFTER Friday June 9th. I'll notify the successful buyers by email.

Price: 25 each $5 postpaid
Price: 50 each $9 post paid
This works out to about half of what Orange Drops cost if you bought them in 100 + quanity. Limit of 50 unless they aren't sold out. Then I will post again for more takers. I'll take checks or postal money orders. No PayPal, credit cards and please don't send cash through the mail. If you do, unfortunately, your on your own. Regards, Perrier

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Date: Fri, 2 Jun 2006 10:37:52 -0700 (PDT)
From: Perry Sandeen <sandeenpa@yahoo.com>
Subject: [R-390] .01 Capacitors Available

The capacitor deal in now OPEN. I must confess that this is the date I had in mind but put in the 9th by mistake.

Price: 25 each $5 postpaid Price: 50 each $9 post paid
Price: 100 each $17 post paid Add $1 (US) more for Canada, eh.

This works out to about half of what Orange Drops cost if you bought them in 100 + quantity. Limit of 100 unless they aren't sold out. Then I will post again for more takers. I'll take checks or postal money orders. No PayPal, credit cards and please don't send cash through the mail. If you do, unfortunately, your on your own. First, send me an email OFF LIST with your complete real name, address and quantity desired. I will then mail the caps. Second, mail me a check (or Cheque if your from Canada, eh) for the amount to:

Perry Sandeen 2575 Elvin Ave. Colorado Springs CO 80909
Non-payers cheerfully acknowledged on list. Regards, Perrier

Date: Sun, 3 Sep 2006 14:41:56 -0500
From: Tom Norris <r390a@bellsouth.net>
Subject: [R-390] C551 needed

Anyone have an extra 2mf cap for C551 laying around in a junker IF deck somewhere? I know it's easy to fix underneath the deck, but in this case I picked up a "spare" deck with everything but that big cap. Figured I ask here before asking at Fair Radio

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Date: Sun, 03 Sep 2006 22:37:19 -0700
From: Renee Deeter_k6fsb <rjdeeter_k6fsb@sbcglobal.net>
Subject: Re: [R-390] C551 needed

Tom-don't bother with the cap they are leaky, best is to use a mylar. If you have access to machine shop make a case for the cap to go in the original spot. Renee, K6FSB

Date: Tue, 05 Sep 2006 11:56:25 -0400
From: Mark Huss <mhuss1@bellatlantic.net>
Subject: [R-390] ReCapping Question

Bit off subject, but I came here because the level of knowledge in recapping is higher here. Besides, we all need a break now and again! I have a Zenith L-600 Transoceanic in transit. Thing is Chock-of-Full of Paper and Black-Beautys. Drawing up a list to order from the origional Replacement Parts List. And noted that there are several capacitors that have the same value and voltage rating, but have different part numbers. For example; 0.01uF 400V that have different part numbers and different prices. Since ceramics and Micas are marked, and these are neather, the question begs itself, what is the difference?

Did Black Beauties have different specs than Wax?
Did Black Beauties have different specs than Ceramics?
Were Black Beauties cheaper than Ceramics?

Another is C18, C35 and C36. C18 and c35 are 120pF 500V Ceramic with one part number and origionally cost $0.30. But C36 is listed as 120pF 500V, has a different part number, and cost $0.35 origionally. Looking at the schematic, C35 bypasses the 16 meter tuned circuit to ground, C18 is in the local oscillator, and C36 bypasses all other tuned circuits besides 16m to ground. Different properties at HF for ceramics? Why would the one handling the highest frequency be cheaper then the one handling the lower, less critical frequencies? Anyone of the Experts want to do a paper on the differences between capacitors and their use depending on frequency?

Date: Tue, 05 Sep 2006 12:24:39 -0400
From: "Tim Shoppa" <tshoppa@wmata.com>
Subject: Re: [R-390] ReCapping Question

According to all the old Sprague advertising, Black Beauties were "hi-spec" parts. I am dubious about such advertising claims! Definitely not as hi-spec as the metal-canned "Vitamin Q's". Today wax/paper and the various mylars/ poly-whatever-lyne have similar overlapping applications (and perhaps some superior characteristics). Some who deal with adverse environmental or overload or pulse conditions will have preferences for one dielectric over another. Below 0.01uF, ceramics tend to be more

economical (and generally have lower inductance making them good for RF bypass), and above 0.01uF the wax/paper/black-beauties tend to be more economical. This divide still exists today (With mylars preferred above .01uF). Between 0.001uF and 0.01uF there's a region of overlap where either may be economical choices. High-K ceramics show a capacitance dependent on applied voltage that makes them a poor choice for some applications and a good choice for others (e.g. bypass).

Date: Tue, 5 Sep 2006 12:07:09 -0500
From: "Cecil Acuff" <chacuff@cableone.net>
Subject: Re: [R-390] ReCapping Question

My 2 cents worth.... Wax and Paper are the same thing. BBOD's were paper caps just packaged differently than the wax dipped variety. Cheapest cap made...

Ceramic was more expensive and more stable and reliable. Physically smaller and can be used as replacements for the paper caps.

Mylar caps as used today in many cases are recommended in coupling applications because they are thought to be a little better at maximizing the audio fidelity. I think they are a bit more expensive than ceramic disks but many folks just use them everywhere as replacements for the paper caps. Another example would be the SP-600 which in the earlier models were full of BBOD's and later the Military spec'd them with all ceramic disks. The general restoration philosophy is to replace all the paper caps with ceramic disks.

Another cap you didn't mention were the mica's. Those were the next step above the ceramic disks on the ladder of reliability and quality. These are beginning to be a problem in many of our old receivers and are usually replaced with modern Silver Micas. I wouldn't replace a mica with a ceramic disk as the micas are usually used in more critical applications effecting circuit tuning/stability etc... NPO ceramics might work but that gets into a whole different can of worms....

If I have errored ya'll let me know....

Date: 5 Sep 2006 18:07:18 -0000
From: "n4buq@knology.net" <n4buq@knology.net>
Subject: Re: [R-390] ReCapping Question

Along the lines of capacitor questions, has anyone seen very many failures for the blue molded capacitors that are prevalant in various R390A modules? See the pictures at Chuck's website below for samples of these.

http://www.r390a.com/html/C-553.htm

I'm wondering if these are considered a very reliable capacitor over time. They do appear to physically have held up well. The cap checker I have is not in the best of shape so I don't have a good way to check them.

Date: Tue, 05 Sep 2006 14:25:06 -0400
From: "Thomas Guest" <Thomas.Guest@TRW.COM>
Subject: Re: [R-390] ReCapping Question

Also keep in mind that the BBOD have value on the ebay place. I also recapped a TO and sold the old caps for more than I paid for the radio and its new caps. .022 is the magic value. Just a thought.

Date: 6 Sep 2006 18:19:23 -0000
From: "n4buq@knology.net" <n4buq@knology.net>
Subject: [R-390] Recapping question

I'm replacing some high resistors in the crystal deck and in the process, am replacing some of the bypass caps. I suspect they could be partially responsible (due to leakage) for the resistors going high. They are the "Erie" brand disk ceramics and their outside surfaces have turned to a sticky, waxy feel which make me think they could be comprimised (not sure about that). I decided that while I was in the area I'd replace them. My question concerns the placement of one of the caps. In the following image, the original cap was connected between point A and the grounding lug at point B.

http://www.knology.net/~thelanding/crystaldeck.jpg

I'm curious why they wouldn't have chosen to put the cap right across the transformer at points A and C. It seems it would have made for less clutter in the other area. Also, from point A to point D might have been just as convenient. Is there a good reason to go with A to B? Maybe it is better to have the components soldered to a common ground point?

Also, for anyone who is interested, here's how I terminated the new RF-to-IF cables under the RF deck.

http://www.knology.net/~thelanding/cables.jpg

Never mind that thing that looks like a blob of solder above the upper-right-hand connection point. It is a piece of tinned wire I clipped and didn't notice until after I had taken the picture. When I tried to retrieve it, I inadvertently knocked it down into the transformer. Rats. Something

else to remember to do before putting this thing back together...

Date: Wed, 06 Sep 2006 14:36:02 -0400
From: "Tim Shoppa" <tshoppa@wmata.com>
Subject: Re: [R-390] Recapping question

My two cents, which you will note is about things that you did NOT actually ask questions about!

1. Those resistors drift up no matter what. If they're charred or burnt or toasty, it's typically because of a past (probably decades-past!) tube fault. Replacing them to put them back into spec is fine if you're in there, hopefully with something that won't drift back up over the years and will also withstand overload better than carbon comps!

2. Waxy disk ceramics do not indicate any problem. When I started tinkering with tube radios in the 60's those ceramics were waxy when nearly new! Disk ceramics that are vaporized, or disk cermaics that are burnt in two, or disk ceramics lacking any covering are usually more obvious clues that something isn't right! You don't often see these failure modes of disk ceramics in receivers although they happen in spades in transmitters.

Date: Wed, 6 Sep 2006 11:39:49 -0700
From: "David Wise" <David_Wise@Phoenix.com>
Subject: RE: [R-390] Recapping question

Ceramics hardly ever go bad, but that's water under the bridge. At 455kHz, the lead length and dress are not critical to the extent that any of the connections you mention would cause different behavior.

My opinion: First, to make it easier to remove the transformer, and to minimize the possibility of damaging it from soldering heat, it's desirable to minimize the number of wires per terminal. A-B is one tick better than A-C. Second, the A-B connection has a smaller chance of B+getting shorted to ground than A-D, because the latter is stretched across more stuff. In this case, neither of the above arguments is compelling, but they could have saved a penny and left out lug B. I would have assembled it A-D.

Date: 6 Sep 2006 18:58:50 -0000
From: "n4buq@knology.net" <n4buq@knology.net>
Subject: RE: [R-390] Recapping question

Actually, lug B has a few more component soldered to it which is why I was considering moving it away from there so it wouldn't have eliminated

that lug by running the cap in question to somewhere else. I like the A to D route too and may use that.

Yes, it's water under the bridge alright. I got started with the wire clippers and just couldn't stop myself :) I have some very small 0.0047 1kv ceramics that make for a lot more room and will be using those in their place. Yes, I realize 1kv is way overkill, but I happen to have them and they are quite small so I'm going with them. I've done pretty much the same thing in another crystal deck I have without much change in the output. This one seems to be rather weak on several bands and am hoping I'll see a small increase in output for my troubles. The new plate resistor and screen resistors will hopefully have the most effect, though.

Date: Wed, 06 Sep 2006 14:01:21 -0500
From: Fred Olsen <fwolsen@wi.rr.com>
Subject: Re: [R-390] Recapping question

> the original cap was connected between point A and the grounding lug at point B. (Why?)

Think "production engineering". Assuming any electrical considerations being more or less equal the component was located where it made sense in production. Some manufacturers would have left out heavy parts such as transformers until the end of the line, if possible. If that were the case it could explain adding a ground lug, to give an upstream assembler a place to hang one end of the cap. That's just one possibility of course but many of these questions simply come down to a matter of practicality and assembly order. No rocket science, no hidden agenda, KISS.

Date: Wed, 06 Sep 2006 15:13:28 -0400
From: Roy Morgan <roy.morgan@nist.gov>
Subject: RE: [R-390] Recapping question

While you are at it, loosen and re-tighten those ground lugs, in fact do it for any and all you can see. Same for any tube socket mounting rings that are used as grounds. Just this tightening can solve all sorts of strange symptoms.

Date: 6 Sep 2006 19:24:06 -0000
From: "n4buq@knology.net" <n4buq@knology.net>
Subject: Re: [R-390] Recapping question

That makes a lot of sense. There are other places where the assembly order had to come into play or there just wouldn't be a way to get the thing soldered together. Case in point are some of the bypass caps on the side of the deck. They attach to another ground lug that is really buried. I

ended up removing it and will solder the caps to it, attach it back to the deck, and then solder the other lead to the terminal strip. There are two other bypass caps done much the same way, but I'm thinking I'm going to leave well enough alone there. Too many parts in that area for the potential to damage them in the process. Hopefully they are still good caps.

Date: 6 Sep 2006 19:31:03 -0000
From: "n4buq@knology.net" <n4buq@knology.net>
Subject: RE: [R-390] Recapping question

That's good advice. I was noticing in the picture that where the other ground lug goes (lower right hand corner of the picture) it appears there is some kind of corrosion(?) buildup underneath where the old ground lug went. I didn't notice that until I looked at the picture. It could just be the picture but I'm definitely going to check that out before I replace the solder lug.

Date: Wed, 06 Sep 2006 15:33:45 -0400
From: "Tim Shoppa" <tshoppa@wmata.com>
Subject: RE: [R-390] Recapping question

Yeahbut this is the crystal deck, and there are frequencies up to 34MHz running around in there. Worst case is that the 6AK5W (which is very capable of VHF operation) breaks out in VHF parasitics. Barry, am I too far off if I guess that the resistors which drifted worst were the 3.9K's?

Date: 6 Sep 2006 20:08:00 -0000
From: "n4buq@knology.net" <n4buq@knology.net>
Subject: RE: [R-390] Recapping question

Yes, the 3.9k plate resistors were both high by nearly the exact same amount (don't remember exactly how much). They aren't charred nor are they 50% or 100% high, but are well out of spec. The 33k screen grid resistor was around 45k if I recall.

Date: Wed, 6 Sep 2006 13:17:14 -0700
From: "David Wise" <David_Wise@Phoenix.com>
Subject: RE: [R-390] Recapping question

Pardon me. I had a "braino" and thought it was the IF deck. A-B, A-C, and A-D are all still short enough.

Date: Wed, 6 Sep 2006 19:53:52 EDT
From: Flowertime01@wmconnect.com
Subject: Re: [R-390] Recapping question

I think you are on with your input. Production and KISS rule in manufacturing.
The engineers have been reassigned and production has a schedule and cost to meet.

Date: Wed, 6 Sep 2006 19:57:33 EDT
From: Flowertime01@wmconnect.com
Subject: Re: [R-390] Recapping question

Great point. Been there done that.

If you have to work on a deck, Get the nut driver, small Philips and small wrench and reset all those mechanical ground points. What a difference it can
make. You can solve problems you did not even know existed.

Date: Thu, 07 Sep 2006 08:17:37 -0400
From: "Tim Shoppa" <tshoppa@wmata.com>
Subject: RE: [R-390] Recapping question

<snip>.... 3. Even though I have a vengance against parts that are 50% or 100% out of spec, I cannot say that replacing them has often repaired anything. Most oscillators were still oscillating, most mixers were still mixing, most amplifiers were still amplifying before and after! Same goes for most leaky wax/paper/electrolytic caps that were measurably or visibly bad: fixing the cap rarely fixes a problem that stopped the radio from working. The only exception is leaky coupling capacitors (some of which were responsible for charring the plate/cathode resistor of the next stage!) Now getting rid of those crackling filter lytics probably was a good idea anyway but despite massive leakage they usually didn't actually cause things to not work (although hum and crackling of course improve after replacement.) By far most repairs are effected by cleaning loose connections, fixing cold solder joints, and cleaning dirty switch contacts. In transmitters things are often more clear-cut, because at least some bad parts (not necessarily the one for the fault!) char, explode, etc. making it more obvious, and usually plate currents in the power stages are metered and will blow a fuse if they go too high.

Date: Thu, 7 Sep 2006 07:41:00 -0500
From: "Cecil Acuff" <chacuff@cableone.net>
Subject: Re: [R-390] Recapping question

My experience has been a bit different in that I have found several occasions where leaky paper caps were the cause of poor performance and after changing them ended up with a much more lively radio and

sometimes correction of weird problems noted during testing or rough alignment work. Resistors have been the same but to a much lesser degree. I'm convinced getting resistors back in spec. lengthens tube life in certain instances where major performance differences may not be noticeable. If nothing else a load was taken off the power supply by removing the cumulative additional load placed there by leaky paper bypass caps.... I have had several cases where in the R1051 series a non-functioning radio was restored to operation by the replacement of shorted bypass caps....

Date: Thu, 07 Sep 2006 08:55:52 -0400
From: "Tim Shoppa" <tshoppa@wmata.com>
Subject: Re: [R-390] Recapping question

I can fully agree that things seem to work better after going through a radio, cleaning it up, replacing out of spec parts, putting in pretty caps to replace the yucky ones, retubing as appropriate, and realigning, but I cannot honestly say that parts replacement did much because as long as I'm into the guts I usually do all the above. Certainly leaky coupling caps being replaced has been part of the above! The black beauties I pull out of 390A's are clearly leaky (as measured with a 9V VOM, not some fancy-schmancy hi-volt leakage test set!) but usually the radio works the same both before and after :-). If you look where they come from, most are just bypasses on cathodes or filament lines where even a few mA of leakage causes only the vaguest symptoms.

Date: Thu, 7 Sep 2006 09:10:24 -0400
From: "David C. Hallam" <dhallam@rapidsys.com>
Subject: RE: [R-390] Recapping question

I can second the message that was posted about saving BBOD's removed from your radios. After seeing what was happening on eBay, I tried selling some and almost fell over at the prices I got. I clearly stated that they had been removed from old radio's and could sell be leaking. As I remember they all went to Japan.

Date: 7 Sep 2006 13:26:46 -0000
From: "n4buq@knology.net" <n4buq@knology.net>
Subject: Re: [R-390] Recapping question

Unfortunately, in the crystal deck, the easier ones are the filament and cathode bypass caps. The harder ones are the plate and screen grid bypasses :(I'm too far into it to stop now, though. They're all going. It's kind of therapeutic for me to take on a challenge and "win". Hopefully it'll ward off some future failures.

Date: Sat, 30 Sep 2006 17:24:18 -0500
From: "Barry" <n4buq@knology.net>
Subject: Re: [R-390] Can anyone ID this capacitor

Still wondering about the voltage rating and tolerance for this one:
http://www.knology.net/~thelanding/100pfcap.jpg

I think it follows the military coding shown below Table 3
(the example is CM 15 B D 332 K N 3):

http://www.electronicsgenius.com/Tech_Info/Capacitors/body_capacitors.HTM
The reason I ask is it is so much smaller than its 39pF cousin. They both are supposed to be 500V, 2%, and I can confirm the CD is that from the CD website for the 39pF cap, but still not sure about the 100pF.

Date: 17 Oct 2006 16:16:02 -0000
From: "n4buq@knology.net" <n4buq@knology.net>
Subject: [R-390] Rebuilding C551 - BTDT?

Has anyone rebuilt C551 (the 2uF AGC cap on the IF deck)? Is it very difficult? I'd like to rebuild it as opposed to just putting a replacement under the deck, but if it's really a pain, then I may just go the easy route.

Date: Tue, 17 Oct 2006 09:28:12 -0700
From: "Craig C. Heaton" <wd8kdg@worldnet.att.net>
Subject: RE: [R-390] Rebuilding C551 - BTDT?

Just depends on how handy you are with tools, and what's in the tool box. I've used a dremel tool to cut open the bottom of a C551, all four sides. Cut off the old wire leads. Then use a wood screw, twist it into the oil/foil/paper and pull everything out, dry out the insides. Next, use a small numbered bit to drill a hole into the lugs on the bottom piece that was cut out with a dremel tool and tap the hole. Gotta use a small drill/tap or else the drill will cut the lug in half. Use the correct size machine screw and solder lug on the bottom piece. Solder on new cap, I used a NTE Mylar found in a local store. Small lengths of heat shrink on caps leads will help. Insert cap into old C551 body and solder the corners. Takes more time to write about the dirty deed than to perform the job. What ever floats your boat, it is your radio. I've got the time and tools.

Date: 17 Oct 2006 16:59:54 -0000
From: "n4buq@knology.net" <n4buq@knology.net>
Subject: RE: [R-390] Rebuilding C551 - BTDT?

That doesn't sound too difficult. I was curious if there were any "gotchas"

like not being able to find a cap that will fit in the old housing or the housing is spot-welded to the frame in places where you can't see it easily, etc. Looks like I have some fun time ahead of me...

Date: Tue, 17 Oct 2006 12:09:48 -0500
From: "Cecil Acuff" <chacuff@cableone.net>
Subject: Re: [R-390] Rebuilding C551 - BTDT?

Also be careful of any oil...it's probably loaded with PCB's and known cancer causing agent.... What ain't!

Date: Tue, 17 Oct 2006 10:33:36 -0700
From: "Craig C. Heaton" <wd8kdg@worldnet.att.net>
Subject: RE: [R-390] Rebuilding C551 - BTDT?

Gonna have to charge for the trade secrets, hi. I got lucky, Norvac, in Eugene, OR had a NTE MLR205K630 hanging on a hook, the last one. It fits inside quite nicely, and is a 2uF @ 630V rated cap. Also note: the mylar 2uF cap works well. The bottom of C551 is pressed into the top section and soldered from the factory. Using a cutoff disk with the dremel tool takes care of this issue.

Turn the cap upside down and cut through the bottom end of the cap, not the sides. The only glitch in the get-a-long is what size bit/tap to use. The old wire leads were crimped into the lugs. I filed the old leads flat/flush with the sealed lugs. Might have to cut/file below the crimped section. Then carefully drill out the old leads with a #43 bit and followed with a 4-40 NC tap. This should be small enough in any case so the drill bit doesn't cut the old lug in half! Some hardware stores will sell the drill bit/tap as one item. A small machine screw and a solder lug will give you something to attach the cap. Another small item, when cutting open the bottom of the cap, keep the cutting disk depth to a minimum. Less oil is sprayed this way, its not PCB, but who likes oil dripping off the walls. Might want to take this task outside to keep peace with the spousal unit. Safety glasses, etc, correct PPE.....

Date: Tue, 17 Oct 2006 10:41:25 -0700
From: Renee Deeter_k6fsb <rjdeeter_k6fsb@sbcglobal.net>
Subject: Re: [R-390] Rebuilding C551 - BTDT?

I've done quite a few- to rebuild C551 first remove it. Next drill a small hole (#60 or smaller) in the bottom to allow the vapor to escape while unsoldering the bottom. (Please think SAFETY FIRST). A small torch was used to melt the solder in removal of the bottom and cleaning it up. Do this upside down (terminals up) to keep the PCB oil in the can. There is not much oil about a teaspoon, just enough to make a big mess! Remove

and dispose of the innards properly. Then solder the new capacitor ie.mylar 1.5 uf or 2.2 uf ,your choice of value(s), to the terminals, assemble and tack solder the bottom back on. reinstall.....easy....

Date: Tue, 17 Oct 2006 10:56:12 -0700
From: "Craig C. Heaton" <wd8kdg@worldnet.att.net>
Subject: RE: [R-390] Rebuilding C551 - BTDT?

Going back into the archives, (I could be wrong), the issue of C551 and PCB oil was discussed. The consensus was the oil was non-PCB. Just the same, whatever, I'll let some of the old timers settle the issue of beating a dead horse/dead horse walking, etc. Seems safer just to cut the cap open with a dremel tool when in doubt, heating any oil with a torch is taking a risk. Adding latex gloves at this point..... Also apologies if needed and looking for my nomex.

Date: Tue, 17 Oct 2006 21:32:33 -0500
From: "Barry" <n4buq@knology.net>
Subject: Re: [R-390] Rebuilding C551 - BTDT?

I'm curious what capacitor some of you guys have used. The 2.0uF, 400V capacitors I've seen are quite large - so much so that I'm wondering if it will fit inside the old housing.

Date: Wed, 18 Oct 2006 17:59:28 -0400
From: "Drew Papanek" <drewmaster813@hotmail.com>
Subject: Re: [R-390] Rebuilding C551 - BTDT?

For an under-chassis replacement I used a Cornell-Dubilier (CDE) DME series 2.2 uF 400v metallized polyester film unit. Mouser carries those. They are about as physically small as you'll find. Others have reported using run capaitors from small motors (non-electrolytic) and even AC line filtering capacitors scrounged from old computer monitors. Mouser carries the line filtering caps as well-instead of a blob they look like a small block. Maybe one of the above would fit in the old can. Electrolytics are completely out of the question-too much leakage even when new.

Date: Fri, 20 Oct 2006 20:31:46 -0400
From: "Tom Guest" <tgbubba@semol.com>
Subject: Re: [R-390] OT - Holy BBODs Batman, hold on to those .022's

The BBOD's and Bumbee caps sell to guitar people. They are used in the tone control of LesPaul and other makers. The .022 400v are the magic parts. I just sold 3 of them out of a Zenith TO and it paid for the radio and the replacement parts. They tested good with no leakage at full rated voltage. It was explained to me that it is used in a low voltage location

and will never see anywhere near the rated voltage. That clear any regrets that I have about selling old parts that would fail in a radio! If you find any in a recap job sell them on epay and on a good day the radio will be free!

Date: Wed, 25 Oct 2006 22:51:48 -0400
From: Carole White-Connor <carolew@bellatlantic.net>
Subject: [R-390] Vitamin Q Caps

I have a 1967 EAC model that I've just started working on. It's a nice set that already performs very well. I've noticed about a half-dozen Vitamin Q caps in the AF deck. What's the collective opinion on these caps? Should they be replaced only if shown to be leaky or should they routinely be replaced? As long as I have the AF deck out, I want to do what needs to be done. My other question pertains to the yellow caps that I saw in the IF deck. They look like metalized polyster. Some of them are lopsided, more oval than round. (I saw the same thing on some of the IF deck pictures on Chuck Rippel's site). Should they routintely be replaced? How do they get lopsided?

Date: Thu, 26 Oct 2006 22:52:25 -0400
From: Carole White-Connor <carolew@bellatlantic.net>
Subject: [R-390] C-103

Another newbie question: I was looking at C-103, the 50 mfd/50V electrolytic on the back wall of the receiver. Here are my questions:

1. How can I determine the polarity of that cap? Is negative the lead with one wire attached or two attached?

2. What does C-103 do? I did not find it in a quick perusal of the schematic.

3. I measured mine. I did not detect any voltage on either prong. Each prong seemed to measure continuity to ground. That has me concerned.

Date: Fri, 27 Oct 2006 09:18:38 -0700
From: "David Wise" <David_Wise@Phoenix.com>
Subject: RE: [R-390] C-103

Two leads - positive, one lead - negative. This is not a critical cap. It parallels the RF GAIN control to keep wiper noise from blowing out your ears as you rotate it. With RF GAIN at max, there will be no voltage across it. You are fighting with both hands tied behind your back if you don't have a service manual. Go to www.r-390a.net and get the latest revision of the Y2K manual. C103 is in Figure 6-35 on page 6-84, and

Figure 5-22 on page 5-52.

Date: Sun, 29 Oct 2006 21:46:53 -0600
From: "Barry" <n4buq@knology.net>
Subject: Re: [R-390] Rebuilding C551 - BTDT?

I finally got around to pulling C551 out of the IF deck. I don't have a torch (yet) but was wondering about something. The insulators for the connections are a somewhat soft rubbery material and it appears the entire can has to get pretty hot to melt that solder seal. Is it possible to head the outside of the can enough to melt the solder without damaging those rubbery insulators? I assume one has to be careful to direct the flame away from them, right?

Date: Thu, 9 Nov 2006 19:20:42 -0600
From: "Barry" <n4buq@knology.net>
Subject: [R-390] 2uF Replacement Cap

Was browsing around for something else and ran across this:
http://www.goldmine-elec-products.com/prodinfo.asp?number=G12711
Looks like a good sub for the AGC capacitor.

Date: Thu, 09 Nov 2006 20:44:47 -0500
From: Carole White-Connor <carolew@bellatlantic.net>
Subject: Re: [R-390] 2uF Replacement Cap

Barry, you're referring to C-551, right? That's the 2mfd/500V cap on the IF module. I have a few questions: 1. Is that a cap that frequently goes bad? 2. How do most people replace it? I have a 2 mfd/630V metalized polyester film cap. However, I'm not sure it will fit under the IF deck.

Date: Thu, 9 Nov 2006 20:52:22 -0600
From: "Barry" <n4buq@knology.net>
Subject: Re: [R-390] 2uF Replacement Cap

Apparently it frequently goes leaky causing improper AGC action when in the SLOW position. Some folks have gutted the original cap and "restuffed" it with a modern one. I plan to do this if possible. I got some 2.2uF caps which should be fine, but I really liked the idea of the "correct" value being in there.

Date: Thu, 18 Jan 2007 11:17:57 -0600
From: "keller family" <kellerfamily01@charter.net>
Subject: [R-390] Orange Drop Capacitors

Does someone know why everyone is replacing every type of capacitor

with Orange Drops where they can get them to physically fit.? Didn't Collins engineers have a good reason for using all the different types of capacitors in the first place?

Date: Thu, 18 Jan 2007 11:55:46 -0600
From: "Cecil Acuff" <chacuff@cableone.net>
Subject: Re: [R-390] Orange Drop Capacitors

The Collins engineers were limited by two things...cost and available technology at the time. There were no doubt better caps available than was used in the R-390A... all one has to do is look back to the R-390/URR to see that, but cost was the culprit. Most of the caps I am aware of that are being replaced in the "A" are paper caps and the Orange Drops are very well suited to the job and should out last the original paper caps by a factor of at least 2. No question other caps available today will also do the job. I've seen anything from yellow poly caps to German made film caps. All will work. I guess if you wanted to you could change them all with ceramic disks as is done in the SP-600 series. I think the Orange Drops have better characteristics for coupling and use in audio stages than the ceramics which are well suited for bypass work. In summary the orange drop is just hard to beat for all around general use....and by all means stay away from anything NOS in paper capacitors.

Date: Thu, 18 Jan 2007 14:21:25 -0500
From: "Tim Shoppa" <tshoppa@wmata.com>
Subject: Re: [R-390] Orange Drop Capacitors

There's nothing fundamentally wrong with over-speccing replacements. Some here get really carried away with it (e.g. putting in 1% resistors everywhere...) There is a certain justification for doing it once in such a way that it won't have to be done again for another 50 years but garden-variety mylars would suffice almost all the time.

But you're right, almost all the brown beauties are used in bypass applications where medium or even large amounts of leakage will have little effect. And where leakage could have caused serious problems (coupling, etc.), they used higher-specced caps (e.g. Westcaps/Vitamin Q's). Some here like to pretend that brown beauties were used in critical coupling situations (e.g. protecting the mech filters) but I have not seen this in any of my 390A's.

Date: Thu, 18 Jan 2007 14:37:15 EST
From: Flowertime01@wmconnect.com
Subject: Re: [R-390] Orange Drop Capacitors

Good stuff from Cecil. The Orange Drops are just considered quality parts.

You expect every one to work as rated and last. There are much smaller parts than the Orange Drops. I used some other small brand in my IF deck. I have so much more space in the deck than before. and more than if I had used the Orange Drops. Most times the Orange Drops are rated 600 volts. And 300 volt or even 250 volt caps will do fine. The lower voltage is smaller parts size. The higher voltage is less likely to fail ever under use at the R390 voltages. Collins was not trying to use bad stuff. You can only buy what is in stock at the hardware store. Collins could only use what had a stock number and was a part that could get issued. Every part that was not a stock item cost money to get into the logistics supply chain. After the front panel, wire harness, filters, RF transformers, how many other new parts do you want to introduce at the cost if there is something in stock already that will work?

Date: 18 Jan 2007 19:56:03 -0000
From: "n4buq@knology.net" <n4buq@knology.net>
Subject: Re: [R-390] Orange Drop Capacitors

I used ODs for my first rebuild and switched to axial-lead caps for the next one. The axial leads are so much easier to work with as the original caps were axial-lead and the configuration was designed around that style. I need to get some pictures of the IF insides to show what I mean. Radial-lead caps are great for some applications, but they are a bit of a pain in others. I do like the ceramic coating, though. It doesn't take much to burn a wax cap with the soldering iron and that's pretty easy to do in some areas of an R390A.

Date: Thu, 18 Jan 2007 16:22:19 -0500
From: <b_hagen@sbcglobal.net>
Subject: RE: [R-390] Orange Drop Capacitors

Almost off topic but since we are talking about why here's a possible reason. I am in the process of repairing a 36 year old color TV with a vertical sweep problem. Well I did do this for a few years back - like 35 years ago but today I don't have a way of running the set with the chassis on the bench so I decided to do the "shot gun" approach. An approach reserved for GE B&W portables in times past, but I digress. So I replaced the 8 or 9 Orange Drops. It did not fix the problem, by the way. Since then all the caps have been checked on my Simpson 383A and all check like new, fresh stock. That's why Orange Drops IMHO.

Date: Thu, 18 Jan 2007 16:40:26 -0500
From: "David C. Hallam" <dhallam@rapidsys.com>
Subject: RE: [R-390] Orange Drop Capacitors

I have agree with Barry. I don't particularly like OD's because they are big

and with the radial leads are usually a PITA to orient properly. I think the coating is epoxy rather than ceramic. SBE has some really nice film/foil axial lead capacitors in their 192P series that generally take about 1/3 the space of an OD. After I remove the old paper capacitors from the boat anchors and replace them with the axial lead ones, there is worlds of space in the chassis.

Date: Thu, 18 Jan 2007 22:30:42 -0600
From: "Barry" <n4buq@knology.net>
Subject: [R-390] Pictures inside my IF deck

I took some pictures of the inside of my IF deck where I used the axial-lead caps instead of ODs:

http://www.knology.net/~thelanding/R390A/IFDeck/InsideIFDeck1.jpg
http://www.knology.net/~thelanding/R390A/IFDeck/InsideIFDeck2.jpg
http://www.knology.net/~thelanding/R390A/IFDeck/InsideIFDeck3.jpg
http://www.knology.net/~thelanding/R390A/IFDeck/InsideIFDeck4.jpg

While I really like ODs, it is just a lot easier to work with these here. Of course, ease of installation isn't the only thing that should drive a decision but I think these are as good as if not better than the BBODs and will last as long (at least I hope they will...).

Date: Thu, 18 Jan 2007 22:50:16 -0600
From: "Barry" <n4buq@knology.net>
Subject: [R-390] AGC Cap Revisited

A few months ago, I discovered that the 2µfd AGC capacitor was leaking and affecting the proper AGC action in one of my R390As. I removed it and attempted to open it up with the intent to restuff it; however, when I tried to unsolder the can with a torch, I decided that the fumes from the hot oil were something that I really didn't want to expose myself to (no one was
really sure they didn't contain PCBs) so I decided to take a different route.

After thinking of a few designs and staring at the open hole as shown below,
http://www.knology.net/~thelanding/R390A/AGC/AGCReplacement1.jpg

it occurred to me that this looks very much like a hole that an octal socket would fit nicely into. Sure enough I found a socket that would fit right in the opening with no modifications to the deck required.

http://www.knology.net/~thelanding/R390A/AGC/AGCReplacement2.jpg

The next picture shows the underside with the connections to the socket complete.
http://www.knology.net/~thelanding/R390A/AGC/AGCReplacement3.jpg

Using a tube base, I easily soldered the new capacitor in place and plugged it in.
http://www.knology.net/~thelanding/R390A/AGC/AGCReplacement4.jpg

Whaddya think? It might not be as "pretty" as the original, but it's sure to work. Also, it makes it convenient, if one should so desire, to be able to plug in different value AGC capacitors to suit however you like it. Of course I wouldn't have done this if the original capacitor had been okay, but since it needed to be replaced, this seemed like a non-invasive and completely reversable approach. I need to replace the carrier-level adjustment resistor and it got late so I haven't put the IF deck back in and tried it yet, but I don't see why it won't work. I plan to machine a small cover to epoxy over the tube base so the capacitor isn't sitting there bare, but it should be fine for now.

Date: Fri, 19 Jan 2007 01:32:08 -0600
From: "Don Reaves" <don@reatek.com>
Subject: RE: [R-390] Orange Drop Capacitors

I wonder if Orange Drops had been available at the time the R-390 was designed if Collins would not have used them throughout the receiver. Bet they would have!

Date: Fri, 19 Jan 2007 11:23:39 -0600
From: Robert Nickels <W9RAN@oneradio.net>
Subject: Re: [R-390] Pictures inside my IF deck

And while I have no relationship with the Bob that is the proprietor of this hobby service, I do know him thru the Antique Radio Club and have had enjoyed his excellent service and prices for axial lead capacitors (and other restoration parts) for years: http://www.radioantiques.com/ (Note his 25 qty prices include shipping. Best deal going!)*

Date: Fri, 19 Jan 2007 20:47:28 -0500
From: "Dave Maples" <dsmaples@comcast.net>
Subject: RE: [R-390] Orange Drop Capacitors

All: I have shifted away from the ODs for precisely the reasons outlined below. I really like the polypropylene caps at AES; I've used them in several refits (including a KWM-2) and have always been very happy with ther esults. Not knocking the ODs...I just prefer the others.

Date: Fri, 19 Jan 2007 20:11:46 -0600
From: "Thomas Frobase" <tfrobase@kitparts.com>
Subject: RE: [R-390] Orange Drop Capacitors

Me to!! They are smaller and easier to work with ... tom, N3LLL

Date: Wed, 24 Jan 2007 20:17:42 -0800 (PST)
From: Perry Sandeen <sandeenpa@yahoo.com>
Subject: [R-390] Re: Parts Selection

<snip> Now about caps. IIRC, film caps are made by two methods. One, the metal conductor is sputtered/applied to the insulating material so that the "foil" that we are used to isn't there making for a smaller cap. "Orange Drop" types actually have the traditional "foil" so are thicker, larger and cost more. As for mylar insulated caps they appear to be only available as third-tier parts. I know years ago they were extremely popular. They are cheap. Neither Mouser or Digi-Key carry them. That personally raises a "red flag" regarding quality.

Additional clarification or corrections of my comments welcomed.

Date: Thu, 25 Jan 2007 09:38:27 -0500
From: "Tim Shoppa" <tshoppa@wmata.com>
Subject: [R-390] Re: Parts Selection

<snip> > As for mylar insulated caps..... <snip>

You're right! When I say mylar I am using terminology I learned decades ago and you are perfectly correct, they don't sell mylars anymore. I am really referring to cheap, small, compact poly film caps unless I'm pulling a part that's been in my junkbox for a couple of decades. Thanks for the correction.

Date: Tue, 13 Feb 2007 12:15:30 -0500
From: "Jim M." <jmiller1706@cfl.rr.com>
Subject: Re: [R-390] Low Sensitivity 8-16 Mhz

Solved ! - After some experimentation and swapping of coil cans, I suspected the fixed mica capacitors inside the Z205 can had failed or drifted in value. Opened the can and replaced the 180 pf and 68 pf mica caps with new ones, and the problem is solved! So not only are the large BBODs a problem in these radios, even the little mica caps can go bad with age. 73 Jim N4BE

Date: Thu, 01 Mar 2007 09:38:00 -0600
From: "John Kopke" <jdkopke@cablespeed.com>

Subject: [R-390] Novice Question for C-609 and others

Hello, I'm trying to find a replacement for c-609 and c-327. I realize I can get the 10 uf 35v replacement for c-609 at the local [Shack] ,but much rather get say a Mallory manufactured component and at the original 8 uf value if possible. . Where does one go and what part numbers ect? Regards

---

Date: Thu, 1 Mar 2007 08:02:50 -0800
From: "Craig C. Heaton" <wd8kdg@worldnet.att.net>
Subject: RE: [R-390] Novice Question for C-609 and others

C-609 rings a bell, c-327 doesn't. Here is a link to Wei-i Li's Pearls of Wisdom. Down load the pdf file on capacitors. The exact military replacement and specs are in one of the post for C-609. By the way C-609 is a wet tantalum, Mouser has wets but are pricey!!! Nolan Lee's post suggests using (from memory) Vishay part# 150D106X9050R2B a solid tantalum 10uF @ 50V.

Date: Thu, 1 Mar 2007 08:05:08 -0800
From: "Craig C. Heaton" <wd8kdg@worldnet.att.net>
Subject: RE: [R-390] Novice Question for C-609 and others

Forgot the link:::::::: http://www.r-390a.net/

Date: 1 Mar 2007 17:40:35 -0000
From: "n4buq@knology.net" <n4buq@knology.net>
Subject: RE: [R-390] Novice Question for C-609 and others

C327 is the cap across the transformer for the 1st crystal oscillator. Chuck recommends checking/replacing it if the oscillator output is low.

Date: Thu, 1 Mar 2007 09:38:20 -0800
From: "Craig C. Heaton" <wd8kdg@worldnet.att.net>
Subject: RE: [R-390] Novice Question for C-609 and others

Oh, the silver mica's. Knock on wood, I haven't been down that road YET! This issue will grow as these boatanchors age. Silver migrates as time goes on until the cap value changes enough or shorts. I did check that one on an old Motorola, it was still good. Bad solder joints kept me searching in that region of the radio. Another reason to keep my Sprague TO-6A.

Date: Thu, 8 Mar 2007 08:42:46 -0600
From: "Cecil Acuff" <chacuff@cableone.net>
Subject: Re: [R-390] New Project Follow-up

<snip> I don't advocate wholesale replacement of resistors but I do paper caps. (only in the "A") Too much history of problems with the paper caps in the "A" series....do yourself a favor, especially since it's a "Creek" radio and change them. It's not that hard....you can pick up a kit with all the caps needed from a couple of different sources on the list. Walter Wilson is one of those.

The probability of causing a component failure in an adjacent component is very dependent on your removal and replacement technique. I advocate high heat and very short durations. Use a high wattage iron and get in and out quickly. A vacuum solder sucking device whether it be the spring loaded type or a vacuum desoldering station is a good thing to have and use. Solder wick is usually too slow and requires too much heat soak...save it for the PC board work. In point to point work like these old radios I use a Hakko iron on a temp. controlled station with a wide (1/4") chisel type tip and run it at 600 to 700 degrees. Low wattage irons require that you stay on the joint for extended periods of time to get everything to melt, heat soaking all the components in the area increasing the chance for further damage. Keep a wet sponge in the iron stand and keep the tip clean and always wet it with fresh solder before hitting the joint to facilitate good heat transfer quickly. Develop a good technique and you'll have little effect. I also use dental tools on those joints to pry the leads open to allow removal. Works great!

Date: Sat, 21 Apr 2007 13:15:25 -0500
From: "Bill & Becky Marvin" <wmarvin@hickorytech.net>
Subject: [R-390] Another Fine Mess?

Hi All Well I may have done a REAL DUMB thing.....while recapping the IF deck with orange drop caps I had no idea that they are polarized, foil outside (Right)..... no markings on them.....will this mistake upset tithe IF circuit???? At least I have a 50/50 chance to rework.....duh !!! Does anyone know where J512 pin 20 (IF) is on the schematic? It eludes me.

Date: Sat, 21 Apr 2007 15:19:57 -0500
From: "Barry" <n4buq@knology.net>
Subject: Re: [R-390] Another Fine Mess?O

The capacitors aren't really polarized, as such. It is usually recommended to use the outer foil in certain applications, but it usually doesn't matter. You won't hurt the cap by connecting it either way as it would if OOit were polarized.

Date: Sat, 21 Apr 2007 13:58:06 -0700
From: "Kenneth G. Gordon" <kgordon2006@verizon.net>
Subject: Re: [R-390] Another Fine Mess?

No, no. Not to worry. It is "suggested" that the "outside foil" be connected to ground since this can improve the shielding and bypassing, and reduce the pick-up of noise, etc., but NOT doing it will most certainly NOT upset the IF circuit! There was an article in ER magazine some time ago concerning the building of a device that would help you figure out which lead is connected to the "outside foil" in those caps on which it is not marked, but in this case, I don't think it will materially effect the receiver. Don't worry about it.

Date: Sat, 21 Apr 2007 17:47:49 EDT
From: ToddRoberts2001@aol.com
Subject: Re: [R-390] Another Fine Mess?

I have always heard it is best to connect the outside foil of a bypass cap to ground. It helps to insure the circuit will be stable and prevent noise and hum pickup. An easy way to find the outside foil in an unmarked cap is to rig up a simple test fixture using an audio amp with either a line-level or mic input. The mic input will be more sensitive. Make up a short lead using shielded wire with the correct plug going to the amplifier input with the ground side going to the cable shield. Put clips on the other end of the cable leads and clip one lead to each side of the bypass cap. Hold the cap between your thumb and forefinger. If hum increases then the outside foil is going to the hot lead. If no hum increase then the outside foil is going to ground. Once you make up the test cable you can check the caps real fast using this method. It also illustrates why the outside foil should go to ground - less chance of hum or noise pickup.

Date: Sat, 21 Apr 2007 17:55:08 -0400
From: Bob Camp <ham@cq.nu>
Subject: Re: [R-390] Another Fine Mess?

Any IF deck that ever has had backwards Orange Drops in it is ruined for all time. Send it to me immediately for disposal. If you take a look at some vintages and builds of IF decks you will notice that some have all the caps in "right" and other builds apparently didn't pay much attention to the outer foil at all. I have never been able to tell a difference between one and the other. The radio will work just fine either way.

Date: Mon, 27 Aug 2007 22:49:39 +0100
From: "Graham Baxter" <graham@delphe.co.uk>
Subject: [R-390] Re: Collins R-390A restoration

> I'm glad to see that not all the BBODs need automatically be condemned!
> I will work my way through your suggestions.
> To test the caps I have a choice of:

> a) Heathkit C-3U R-C Bridge with 450V leakage test (EM34 Magic Eye
> indicator), or
> b) Solartron stabilized variable PSU at 450V DC max through (say) 50K
and
> metered externally on an Avo.
> I also have a cranked Megger at 625/1250/2500 V but this is rough a.c.
so
> not suitable for capacitors I reckon.
> However I don't have anything I would recognise as a "high resistance
> meter"; is (b) above the same thing?
> Thanks for the manufrs references, by the way; makes it easier.

I think the Solartron PSU is a good way to kill yourself. I had one of those and I foolishly gave it away. I dont think I would recommend your using it as a capacitor tester. In any event, 50k is a bit low. I would be thinking in terms of megohms in order to protect both yourself and your AVO.

The Heathkit bridge with leakage detection sounds ideal for this job. I think you are right, the hand cranked Meggar probably has too much ripple.

The brown tubulars have been the subject of a vigorous debate in the past. My view for what its worth is if they measure correctly and they don't leak using your Heathkit tester then it would be a shame to spoil the originality of your radio.

Graham

> From: grahambaxterdelphe@googlemail.com
> Sent: 27 August 2007 13:39
> To: Brian McCagherty
> Subject: Re: Collins R-390A restoration
>
> Hi Brian,
>
> I think it is important to establish at the outset that usually there
> are very few faulty resistors and capacitors in an R390A which has
> been kept in a sheltered location.
>
> The only components I would replace as a matter of course, are the
> filter coupling capacitor C553 and then rebuild the main octal based
> smoothing capacitors.
>
> C553 is neatly replaced by
> PC/HV/S/WF 10NF 1KV - LCR COMPONENTS - CAPACITOR, 10NF
1000V

> Manufacturer: LCR COMPONENTS
> Farnell Order Code: 9520317
> Manufacturer Part No: PC/HV/S/WF 10NF 1KV
>
> The electrolytics can be rebuilt with:
> EEUED2V470 - PANASONIC - CAPACITOR, 47UF 350V , 2 off>
> Manufacturer: PANASONIC
> Farnell Order Code: 9696440
> Manufacturer Part No: EEUED2V470
> RoHS : Yes
> and
> EEUED2V330S - PANASONIC - CAPACITOR, 33UF 350V , 3 off
> Manufacturer: PANASONIC
> Order Code: 9696431
> Manufacturer Part No: EEUED2V330S
> RoHS : Yes
>
> I would test all the caps with a high resistance meter at 500v. If the
> leakage is not significant, leave them alone. In my view an R390A full
> of unnecessary Orange Drops just arouses suspicion and has less appeal
> to a collector. Clearly if a faulty component is having any effect on
> the performance it should be replaced.
> Let me know how you get on.

Date: Tue, 28 Aug 2007 16:47:32 -0400
From: "Drew Papanek" <drewmaster813@hotmail.com>
Subject: [R-390] Re: Collins R-390A restoration

The Solartron power supply can be used along with a high impedance voltmeter (DVM suitable) as a very sensitive capacitor leakage checker. Set the power supply to the desired test voltage. With due respect for the high voltage, connect the power supply, meter, and capacitor under test all in series. The leakage current is found by dividing the meter reading by the meter's input impedance. You can find out much more on the topic of capacitors (and all other topics) pertaining to the R-390 series at r-390a.net In particular, check out "Pearls of Wisdom" on the the "references" page.

Date: Tue, 28 Aug 2007 20:04:17 -0400
From: "Dave Maples" <dsmaples@comcast.net>
Subject: RE: [R-390] Collins R-390A, new owner

All: While we are discussing paper cap replacement, I seem to have very good success with the polypropylene caps sold at Antique Electronics Supply (no relation). I did Orange Drops for my R-390A IF upgrade, but have found the caps at AES to be easier to work with (true axial caps vs.

the "radial" Orange Drops). Specs appear to be as good or better AFAIK. Anyone else ever used these?

Date: Tue, 28 Aug 2007 20:30:33 -0500
From: "Barry" <n4buq@knology.net>
Subject: Re: [R-390] Collins R-390A, new owner

I recapped my second R390A with those. It sure makes the job easier! I only hope they hold up as well as the Orange Drops that I used in my first recap job.

Date: Tue, 28 Aug 2007 20:33:34 -0500
From: "Barry" <n4buq@knology.net>
Subject: Re: [R-390] Collins R-390A, new owner

By the way, you can see how these look/fit here:
http://www.knology.net/~thelanding/R390A/AGC/AGCReplacement3.jpg

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Date: Wed, 29 Aug 2007 07:40:55 -0700 (PDT)
From: wli <wli98122@yahoo.com>
Subject: Re: [R-390] Collins R-390A, new owner

What I did was run my fused Variac to a surplus TV power transformer, giving me 0-400 VAC. A simple single stage LC filter gave me 0-400VDC to check my capacitors. By hanging a voltmeter and a milliameter across the output, this makes a cheap, AC isolated, and safe utilitarian supply to check and reform R390 electrolytics. Mine is in its own grounded case with all hot points protected (from me). If reforming electrolytics is your goal, then this gizmo can do it, as you monitor the current levels. This may take hours! If all you want to do is check gross leakage, then run the voltage up to the rated levels and see the current passed. Throw out any electrolytic that leaks more than 5 mA (my personal criterion). Hook up a 11M VTVM in series with the hot lead and an unknown smaller capacitor, connect the grounds together, and now you have (as was previously mentioned by others) a megommeter. Any current passed by the cap will show up as a voltage drop across the 11M input string of the VTVM. So a voltage reading of 0.09V is a current of 1μA.Here I reject any cap that passes more than one microamp.

All of this was presented much more eloquently by Dr Jerry and Roy Morgan in years past.

Date: Sun, 25 Nov 2007 08:42:30 -0500
From: Bob Camp <ham@cq.nu>
Subject: Re: [R-390] ReCap Kit

I went out and did this all on my own. Finding and ordering the best parts for the job is not trivial. Most of what you come across is "close but not quite right". It's been a long time since chassis mount (vs PCB or SMT) caps were the big thing. Once you find the right stuff, they only want to deal with you in quantity. Ordering just one or two is pretty expensive. The $80 price may seem a bit steep, but it's not bad for the full set. Of course my way you have a more than lifetime supply for ten or twenty radios. They easily cost me as much as another R-390 ....

Date: Thu, 24 Jul 2008 19:52:31 -0700 (PDT)
From: wli <wli98122@yahoo.com>
Subject: [R-390] re: R-388 caps (OT)

How durable the *dogbone* ceramic capacitors in the R-388/URR? They are widely employed as bypass caps... like .01μF everywhere it seems. How were they made? Do they deteriorate like the paper caps of that era? My impression is no. But I do not really have any experience with this type of capacitor.

In contrast, I have seen many leaky *Black Beauties* in other receivers I have restored, and have replaced them with Orange Drops or other modern caps.

Date: Fri, 25 Jul 2008 08:12:00 -0700 (PDT)
From: John Flood <kb1fqg@yahoo.com>
Subject: [R-390] R-388 caps (OT)

This interests me as well as I am doing a "quick" cleanup and checkout of a R388A for someone local who was "Given" one and had no clue what it was. He couldn't understand why I was drooling over the dust covered black thing and he couldn't get my attention to the complete shiny Hallicrafters station with matching speaker that was given to him at the same time. Then he said take it home and check it out and play if you want. Thought about saying no but not for long... where was I.... oh ya those dogbone caps. He doesn't want me to do a complete restore of it but I'd like to advise him about these and I have not run into these caps much before. This unit is running well at this point with little work, just a cleaning, a new tube and lamps. I know you'll all say check the caps but what I was mainly looking for here are these dogbones in the same class as the BBOD's and must be removed at all cost while the children are hidden to protect innocence or are they of higher quality breeding like single malt medicinal compound?

Date: Fri, 25 Jul 2008 15:52:16 -0400
From: "Al Parker" <anchor@ec.rr.com>
Subject: Re: [R-390] R-388 caps (OT)(not)

I haven't run into problems with the dogbones (yet), but you never know. The small micas are starting to go, in the R-388 particularly watch out for C-204, 100mmf coupling cap in the AVC section, just above V-110 in the skem. That one gets leaky, and really messes up the AVC, the rcvr will go deaf. It can be heat sensitive, best thing is to just replace it in every R-388, it's happened to me in 2 or 3 and I know of several others.

The bathtubs can get leaky and make strange things happen, too, but not as drasticly as C-204. You should look at the bias voltage generation setup, coming from the CT on the pwr Xfmr secondary, incl. C-205A, C-126, and the resistors iin that line that gooes twd C110 & back to ground. I've got notes from someone on what should be there, maybe Lankford, I can't remember, but will hunt them down if you guys don't find them. That, andthe PTO endpoints, are the only 2 other things that you really need to watch out for in the R-388. <snip>

Date: Mon, 28 Jul 2008 17:13:29 -0400
From: Roy Morgan <k1lky@earthlink.net>
Subject: Re: [R-390] R-388 caps (OT)

> ... doing a "quick" cleanup and checkout of a R388A for someone > local... those dogbone caps. ... in the same class as the BBOD's and > must be removed at all cost ...?

The dog bones are ceramic and of quite low value - such as 2 to 50 pF. I overhauled an SX-88 not long ago which had one burned up and one shorted. Unusual. If you want a radio to last and be used forever hence, replace them, but if they are working ok for now, expect no real trouble.

On the R-388: There is a bathtub can cap under the chassis that is an electrolytic, I believe. This is unexpected because normally caps of that shape are paper caps of modest value. Find it and replace it either by de-gutting it or placing replacements nearby on a terminal strip. Of concern are any silver mica caps you may find. They are suspect now. Get new replacements from Justradios.com in canada. Good prices, friendly service, and prompt filling of orders. http://www.justradios.com/

I have a J-4 handy but have not yet started any restoration on it.

Date: Mon, 28 Jul 2008 23:50:28 -0400
From: Roy Morgan <k1lky@earthlink.net>
Subject: Re: [R-390] R-388 caps (OT)

>> Of concern are any silver mica caps you may find. They are suspect
>> now. Get new replacements from Justradios.com in canada....
>

>.....dipped in orange epoxy like Sprague Orangedrops used to be." ... I would use nothing but Vishay/Sprague 715P or 716P metal foil and polypropylene caps .....

Modern caps are far and away more reliable in general than the old ones were even when new.

> until we have 40 years of experience .....

The modest cost increase for true "Orange Drops" is not a big thing compared to the time and effort to get then IN there! (I look forward to doing a couple of SP-600's that I own.)

>... I never use film capacitors as bypass caps -- ceramics are much superior >in that role, ... the >best part for the job when I'm putting in the effort to replace >50+ capacitors in devilish locations in a radio.

Indeed. I overhauled an SX-88 not long ago.. the thing may be worth $5,000 or more now that it is running well! And talk about devilish locations!!! I did use disk ceramics for bypass functions. The original caps in the front end working from BC band to 120 mc were tubular papers with braid leads on them - special order no doubt. Note: My security advisors tell me to state that the SX-88 is NOT mine,and has gone back to its owner. (They threatened to charge me stiffly to increase the chain link fence to 10 feet, and for putting on more dogs for the night patrol.)

Date: Sat, 13 Sep 2008 09:42:21 -0700 (PDT)
From: Perry Sandeen <sandeenpa@yahoo.com>
Subject: [R-390] Old style Mica Capacitors

Dan's Small Parts is selling "grab bags" of the old style molded mica caps. Even better he is having a sale now where everything is 25 percent off. Looks like it's time to stock up for the winter projects.

Date: Sat, 13 Sep 2008 14:06:43 -0400
From: "Al Parker" <anchor@ec.rr.com>
Subject: Re: [R-390] Old style Mica Capacitors

I wonder if "NOS" ones go bad at the same rate as ones in service? Having problems with some in R-388's & a few others nowadays. The 100 mmf's in the AGC ckt in particular. I've been using dipped micas as replacements, they're getting pricey. He does have some nice grab-bags tho', particularly if you use LV stuff.

Date: Sun, 14 Sep 2008 20:46:00 -0700 (PDT)

From: Perry Sandeen <sandeenpa@yahoo.com>
Subject: [R-390] Silve Mica cap question

Wrote: I have had very poor results with NOS micas from a variety of sources that were made before 2000, so I don't buy them anymore. <snip>
Could you please expand? I have a bunch of epoxy dipped silver mica's that I've acquired over the years. Some are probably 30+ years old and most don't have a date stamp on them. Or are you referring to NOS molded Micas? If you are referring to the epoxy dipped SM's, is there a simple way to test for leakage? I have a Marconi LCR bridge that is SS. Does one need a Sprague TO-6 or something similar with a HV leakage test? I sure don't want to have to replace a replacement but I also don't want to throw away the SM's I have.

Date: Mon, 15 Sep 2008 08:42:57 -0500
From: "Cecil Acuff" <chacuff@cableone.net>
Subject: Re: [R-390] Silve Mica cap question

I have come into this late but my experience is that molded micas are much more an issue than the dipped silver micas. I don't see silver micas fail often..in fact I probably haven't replaced one in several years. I know they go bad occasionally but not nearly as often as the molded micas. I have quite a few silver NOS caps and will use them without fear. I will check them at their rated voltage before installing one but usually find them to be fine. Perry I would find a cap checker that checks at rated voltage. I am partial to the Sencore LC53 and LC73 capacitor/inductor testers. I'm currently using an LC-77 and it has become my favorite. They show up on the auction site and are excellent for testing all type of caps. I wouldn't buy NOS micas but wouldn't hesitate to pick up NOS silver micas for use in our old radio's....

Date: Tue, 23 Sep 2008 20:36:38 -0500
From: "Barry" <n4buq@knology.net>
Subject: [R-390] Slighty OT: Question about tantalum caps

I think I mentioned on this list that I'm in the process of thinking about considering the possibility of maybe one day building a 9VDC power supply for one of my radios. Yes, it's solid state and begins with a "G" (and ends with "rundig") so if you want to stop reading here, I understand. I was getting the parts list together and the circuit calls for a few miscellaneous caps, one being a 47uF 50V Solid Tantalum cap. Perusing the Mouser catalog, I find this capacitor is quite expensive (in excess of $20 each). Can anyone explain to me the advantage of using a solid tantalum over some other "plain-jane" capacitor? The circuit uses an LM317K and this particular capacitor is connected across the output just before the ammeter and voltmeter. (The circuit is in the 1978 ARRL

Handbook (page 127)).

I was fortunate to have meters that will make the project nice and figured that would be lion's share of the cost, but this little cap (along with a couple of other items) have really driven the cost of building this thing nearly out of sight. Can someone/anyone tell me if another type of cap would work as well? Are the caps of today better than those of 30 years ago, so much so that maybe the solid tantalum wouldn't be necessary?

Date: Wed, 24 Sep 2008 08:16:31 -0400
From: Gord Hayward <ghayward@uoguelph.ca>
Subject: Re: [R-390] Slighty OT: Question about tantalum caps

I suspect the reason is less inductance. Inductance can cause regulators to oscillate so all leads must be short. I've had lots of tantalums blow up on me so I prefer the blue electrolytics bypassed with a 0.1 ceramic. These seem to work very well.

Date: Wed, 24 Sep 2008 07:34:32 -0500
From: glwebb@gundluth.org
Subject: [R-390] Re: Tantulum Capacitors

My somewhat faulty memory says that the big advantage of tantulums is that they have lower leakage compared to a similar value common electrolytic capacitor. I used to see a lot of them in medical equipment. In the circuit you described, maybe a low-leakage electrolytic would do the job fine. I would try that, or if you want to use tantulum, parrallel 10's 15's or 22uf's.

Date: Wed, 24 Sep 2008 10:37:34 -0400
From: "James A. (Andy) Moorer" <jamminpower@earthlink.net>
Subject: Re: [R-390] Slighty OT: Question about tantalum caps

It used to be that the tantalums had better high-frequency response, and the alluminum electrolytics had some nasty breakdown (i.e., blowout) problems combined with relatively short lifetime. The electrolyte would dry out with time.. Back "in the days" while chasing a low and buzzy B+ rail, I experienced a catastrophic capacitor failure that blew the can all the way across the room, luckily missing my left ear by a comfortable margin and spreading some nasty, corrosive goo all over the power supply. Today's alluminum electrolytics are light-years better than those from the 50's and 60's and can go anywhere that an electrolytic is needed. All the great "computer-grade" electrolytics these days are alluminum. To make sure you catch the higher frequencies, as noted earlier, parallel it with a .01 or .1 ceramic or dipped mica or something. As always, keep the leads short and avoid too many bends and kinks in the wiring. If you are

feeling particularly studious, look for the capacitors with the lowest ESR and highest lifetime - the Mouser catalog gives you these numbers - but that is mostly overkill. Just don't try to lowball it too much.

Date: Wed, 24 Sep 2008 17:14:47 -0400
From: "Ed & Mary Wambold" <n3lhb@embarqmail.com>
Subject: [R-390] Re: Slighty OT: Question about tantalum caps (Barry)

47 mf @ 50v is 47 mf @ 50v, it does matter what type of cap you use, unless you are concerned about physical size. Tantalums are more compact and other than that, they are equivalent to regular electrolytics...

Date: Wed, 24 Sep 2008 14:23:59 -0700
From: David Wise <David_Wise@Phoenix.com>
Subject: RE: [R-390] Re: Slighty OT: Question about tantalum caps

Depends on how much you ask from your caps. Compared to aluminum, tantalums

(a) are more stable in value

(b) are less leaky

(c) have lower ESR

(d) have lower dissipation factor

(C) is less true than it used to be, with the development of low-ESR aluminums, but in resonant or timing circuits that need a big cap, if there isn't room for film, tantalum still rules.

Date: Wed, 24 Sep 2008 18:10:45 -0400
From: "Dave Maples" <dsmaples@comcast.net>
Subject: RE: [R-390] Re: Tantulum Capacitors

All: I just looked up the datasheet on the LM317K and it calls for a 10 uf cap paralleled by a 1 uf tantalum on the output, and a 0.1 uf cap on the input. I don't see any call for a 50 uf tantalum anywhere. Of course, I'd feed this thing from a full-wave bridge with several thousand uf for a filter, as is done in a typical PS. Why not do this? Look on craigslist or freecycle for an old PS for a CB rig. Probably 12 VDC at an amp or two. Turn it down to 9 VDC. Of course, you don't get the satisfaction of building your own 9 VDC PS, but so what?

Date: Wed, 24 Sep 2008 17:42:42 -0500
From: "Barry" <n4buq@knology.net>

Subject: Re: [R-390] Re: Tantulum Capacitors

That's part of the satisfaction. I like to build things. I want to build it in a custom housing that the Grundig will sit on top of and house a couple of speakers. The radio has its own power supply, but its probably a switching style and I want a nice, "quiet" power supply. I've decided to go with low-leakage aluminum electrolytics. Cuts the cost waaaay down. Thanks for all the input guys!

Date: Wed, 24 Sep 2008 19:25:41 -0500
From: "Jim Shorney" <jshorney@inebraska.com>
Subject: Re: [R-390] Re: Tantulum Capacitors

Lower leakage and lower ESR. However, they are extremely vulnerable to death by surge. I've seen recommendations that you should derate the voltage rating to 1/3 in power filtering apps. So 50v for a 12 (or 9) volt supply is reasonable. I avoid using them for such applications. A good quality electrolytic rated for 105 degrees C tempertatures is prefereable IMO.

Date: Wed, 24 Sep 2008 19:55:06 -0500
From: "Jim Shorney" <jshorney@inebraska.com>
Subject: RE: [R-390] Re: Tantulum Capacitors

Do what the data sheet says. In my experience, they have very good reasons for putting capacitors at certian spots, and strange things can happen if you don't follow the data sheet recommendations.

Date: Wed, 24 Sep 2008 20:55:43 -0400
From: "Ed & Mary Wambold" <n3lhb@embarqmail.com>
Subject: [R-390] Re: Slighty OT: Question about tantalum caps (Barry)

Correction: Barry, 47 mf @ 50v is 47 mf @ 50v, it does *not* matter what type of cap you use, unless you are concerned about physical size. Tantalums are more compact and other than that, they are equivalent to regular electrolytics...

Date: Mon, 10 Nov 2008 07:21:40 -0600
From: "Barry" <n4buq@knology.net>
Subject: [R-390] OT: Wet or Solid Tantalum?

Can someone take a look at eBay item 200271172495 and tell me if this is a wet or solid tantalum cap? Seller states it's wet, but I emailed him asking why he made that determination and he replied that he wasn't really sure and assumed wet. I need a 47uF/50V solid tantalum.

Date: Mon, 10 Nov 2008 07:29:37 -0600
From: "Barry" <n4buq@knology.net>
Subject: Re: [R-390] OT: Wet or Solid Tantalum?

I asked the seller to send me the designation written on the cap. That should help, but thought someone might be able to tell from the picture what type it is. I'll forward the designation info if needed when I get it.

Date: Mon, 10 Nov 2008 09:40:37 -0500
From: Roy Morgan <k1lky@earthlink.net>
Subject: Re: [R-390] OT: Wet or Solid Tantalum?

I looked at the ad and can't tell. Maybe some info from the case will help. BUT, you no doubt noticed that the things are in England, and postage plus hassle may make it more trouble than it's worth.

> Seller states it's wet, ... I need a 47uF/50V solid tantalum.

What on earth for? Not the audio deck in an R-390, I assume. The special characteristics of tantalum caps are seldom really needed. His ad tells about twenty pound price from Digikey. Seems very unreasonable and a common electrolytic cap may do just fine.

Date: Mon, 10 Nov 2008 09:48:29 -0500
From: Barry <n4buq@knology.net>
Subject: Re: Re: [R-390] OT: Wet or Solid Tantalum?

It's for the output on an LM317 power supply. As I understand it, the tantalum's properties are called for in this application (low ESR, frequency response, etc.) and a "solid" tantalum is specified in the schematic. Believe it or not, a 47uF/50V solid tantalum runs over $20 with Mouser and I assume the same for other e-tailers. His shipping price to the US seems quite low (1.75 bp). Total cost should be a LOT less than a new one. Of course, it could be a really old cap and not worth it at all... Thanks (and good to hear from you!)

Date: Mon, 10 Nov 2008 10:08:22 -0500
From: "Tim Shoppa" <tshoppa@wmata.com>
Subject: Re: Re: [R-390] OT: Wet or Solid Tantalum?

It's just a LM317. It does not need a fancy-pants $20 tantalum (wet or dry). I don't care what the schematic says or what the application is.

Run-of-the-mill electrolytics these days are surprisingly low ESR, compared to what was on the shelves in the 60's and 70's. And low-ESR-spec electrolytics (small price premium) are even better. The reason for

the current emphasis on low ESR is the vast use of switching supplies everywhere, they were not so common back in the 60's and 70's.

Almost all LM317 applications need nothing more than a ceramic disc (or monolithic ceramic, very very common today) at the output. If there are very large current draw spikes (think 70's era TTL) then a modern low ESR electrolytic or a much smaller (e.g. 1uF) tantalum in addition to the ceramic cap will be fine. Modern TTL series do not draw huge current spikes. Analog circuits will almost never draw big current spikes, if they do then honestly there's a more fundamental design problem.

Date: Mon, 10 Nov 2008 10:21:34 -0500
From: Barry <n4buq@knology.net>
Subject: Re: Re: Re: [R-390] OT: Wet or Solid Tantalum?

In the National spec sheet for the LM117/317, some of the designs - particularly the ones for high-current applications - show 47uF and even 100uF tantalums (wonder where you find one of those?) across the output. My application will not usually require a high current drain (< 1 amp in general) and should not pull heavy current spikes either. I guess I don't understand the purpose of this cap. Is it to supply momentary heavy current draws that the regulator (or other supply components) would have trouble delivering? If not, then what is it for?

Date: Mon, 10 Nov 2008 10:44:01 -0500
From: "Tim Shoppa" <tshoppa@wmata.com>
Subject: Re: Re: Re: [R-390] OT: Wet or Solid Tantalum?

Most of the LM317 data sheet dates from the 70's back when electrolytcs weren't so low ESR. And back then the dominant logic family was TTL which insanely short-circuits Vcc to ground whenever there's a logic transition. 47uF and 100uF tantalums aren't so expensive, if you buy them for 6.3V. Still, tantalums went out of style for TTL bypassing back about 1973 :-). With a little care in PC board layout they discovered that small ceramic capacitors (by the late 70's, monolithic ceramic capacitors) right at the TTL package was way way better and cheaper than big tantalums.

> My application will not
> usually require a high current drain (< 1 amp in general) and should
> not pull heavy current spikes either.

1 Amp is a high current drain for a LM317. If the voltage drop is anything more than a few volts you'll need heatsinking.

> I guess I don't understand the purpose of this cap. Is it to supply

> momentary heavy current draws that the regulator (or
> other supply components) would have trouble delivering?
>If not, then what is it for?

Conceptually you've got it right, it's a bypass capacitor. As a small hint, if you're paying 20 times for a bypass capacitor for a device than the device itself costs, something's out of whack in the design. It's like discovering the steering wheel for your Ford Escort costs half a million dollars and is solid gold. Hobbyists, especially audio hobbyists, place way way way too much emphasis on honkin' big bypass capacitors when commercially they discovered much better filtering methods like 70 years ago. Design-wise, if you have a design that needs honking big low ESR bypass caps then the design has high pulse currents. Unless the purpose of the circuit is to have high pulse currents (think "coin shrinking"), this is an indication that it's a poor design. Some regulators have stability issues without the right bypassing. LDO's are well known for breaking out into oscillation if you use too low an ESR cap!

Date: Mon, 10 Nov 2008 11:03:25 -0500
From: Barry <n4buq@knology.net>
Subject: Re: [R-390] OT: Wet or Solid Tantalum?

> 1 Amp is a high current drain for a LM317. If the voltage drop is
> anything more than a few volts you'll need heatsinking.

I'm planning on using a pass transistor and heatsinking both devices. I ordered a couple of heatsinks but on the advice of another list member, am looking for something more substantial and think I've found it.

> As a small hint, if you're paying 20 times for a bypass capacitor .....

That seems to be what's going on here. I put my money into the transformer, rectifiers, and filter caps. I just wanted to make sure that if I didn't go with the solid tantalum, the regulator would still perform properly (e.g. not break into
oscillation, etc.). Sorry for the OT bandwidth guys. I need to shut up and just build the stinkin' thing...

Date: Mon, 10 Nov 2008 13:58:33 -0600
From: "Skip Frolik" <frolik@gulftel.com>
Subject: Re: [R-390] OT: Wet or Solid Tantalum?

On an old Centronix Printer Board .... You're up in Huntsville Barry. Just slide over to the arsenal and rob one off all those old junk printers they have in the back room .... Hehehe. On a more useful (maybe) note a lot of scrap computer modules (Centronix) used axial 47 and 100uf caps at 50v.

They were made by Nippon Chemi-Com. I'm pretty sure most of them were of the tantalum type.
I know I've replaced and pirated my share of them .... Hi. According to Sencore (if you trust them) from their LC102 manual .... "The lead weld, shown in figure 43, is an identifying characteristic of the tantalum in electrolytic and is a quick was to differentiate between an axial lead aluminum lytic and a tantalum lytic. Aluminum lytics do not have a lead weld on either terminal."

Might come in handy while dumpster diving for components and you could find you have more tantalums in the junk box then you think including that elusive 47uf at 50v. Just some "Babbling BS" for your amusement .... Hi.

Date: Mon, 10 Nov 2008 14:20:22 -0600
From: "Bill Hawkins" <bill@iaxs.net>
Subject: RE: [R-390] OT: Wet or Solid Tantalum?

IIRC, the wet tantalums that I've seen in 60's HP gear have a larger diameter at one end for the electrolyte seal. That's where the gunk gets out and messes up the circuit board. The ones in England, with the blurry photo, are almost certainly solid electrolyte caps.

Date: Mon, 10 Nov 2008 15:28:01 -0500
From: Barry <n4buq@knology.net>
Subject: Re: [R-390] OT: Wet or Solid Tantalum?

Is that little bell-ended cap (the one that has usually leaked) on the PC board in the AF deck on an R390A a wet tantalum?

Date: Mon, 10 Nov 2008 15:39:44 -0500
From: rbethman <rbethman@comcast.net>
Subject: Re: [R-390] OT: Wet or Solid Tantalum?

Yep! That's THE one! The reason they eat the board is the "old" wet tantalum capacitors had an acid electrolyte.

Date: Mon, 10 Nov 2008 15:42:36 -0500
From: rbethman <rbethman@comcast.net>
Subject: Re: [R-390] OT: Wet or Solid Tantalum?

Take it for what its worth, but there used to be a list member that put together and sold cap kits for the R-390A. The solid (or dry), tantalums that are out there are usually sort of egg shaped, green or blue in color, ans the leads come out one end. They are NOT axial.

Date: Mon, 10 Nov 2008 15:24:28 -0600
From: "Bill Hawkins" <bill@iaxs.net>
Subject: RE: [R-390] OT: Wet or Solid Tantalum?

The straight cylinder types of the 60s and 70s were definitely solid axial tantalum caps. I've used many of them on an industrial budget. The green eggs are recent.

Date: Mon, 10 Nov 2008 15:35:15 -0600
From: "Barry" <n4buq@knology.net>
Subject: Re: [R-390] OT: Wet or Solid Tantalum?

I think I used one of those on a rebuild I did and I do recall they were not axial lead'ed.

Date: Mon, 10 Nov 2008 22:06:09 +0000
From: eldim@att.net
Subject: Re: [R-390] OT: Wet or Solid Tantalum?

The one pictured on the ebay acution in the UK is a U.S.A. Manufacted Tantalum (sintered wet slug), but only very mildly wet if memory serves me correctly. If they have a silver casing, and I do mean real (silver), then the solid tantalum slug inside is machined smooth and is connected to solid tantalum wire that exits thru a Teflon bushing. This is a wet type that has a Potassium-Hydroxide (alkaline) solution to form the electrolyte. This last type of Tantalum is known for it very high accuracy, stability and does not change with altitude, and temperature. I have a brochure from one of the major areospace from years ago buried somewhere in my library which is blocked at this time. Tantalum come in rod form, solid wire, and foil. The prettist is the two different colored foil sheets that is spooled in the TANTA-LEX electrolytics manufactured by GE which is encased in an aluminum cased with axial welded leads. The two Tantalum foil types are seperated by a wet impregnated paper (that stinks), but is required to form the dielectric. Hope that this info helps and is correct as my memory is slipping.

Date: Mon, 10 Nov 2008 17:01:15 -0600
From: "Barry" <n4buq@knology.net>
Subject: Re: [R-390] OT: Wet or Solid Tantalum?

The point may now be moot but he did send me the markings:

+H/E HNW 47 + - 10% +50VDC 7911

After re-reading National's application notes for the LM117/317, it states that 1uF is all that's really needed on the output. Not sure why their

"typical designs" show more than that (apparently it's application dependent), but I think I'm going with 1uF. If I have problems with it, I can always exchange the value later. The application "hints" go on to say that for better ripple rejection, a 10uF is recommended on the ADJustment line and I plan to use that, but the output's only getting a 1uF cap. Thanks again, guys. I guess I need to return the list to its regularly-scheduled R390[A] program.

Date: Thu, 11 Dec 2008 20:26:09 -0500 (EST)
From: "Richard W. Solomon" <w1ksz@earthlink.net>
Subject: [R-390] R-390A IF Module Layout

Is there available a picture or pictograph showing the component layout (position) of the under-side of the IF Module? After getting mine out I see that it is infested with BBOD's. It would help me make a list of Orange Drops I need to order. Side note: Too bad the Audiophools have latched on to OD's. The price on e-Pay is absurd and assortments (at a reasonable price) are hard to come by.

Date: Thu, 11 Dec 2008 20:32:02 -0500
From: "Al Parker" <anchor@ec.rr.com>
Subject: Re: [R-390] R-390A IF Module Layout

I dunno what they're going for on epay, but you can buy whatever qty & values you want from Mouser.com, no min. order, no handling chg, just the actual shipping cost. Good to do business with. No relation here, just a satisfied long-term customer. Buy oft-used 0.01's (or others) in qty & save more.

Date: Thu, 11 Dec 2008 19:39:08 -0600
From: Grant Youngman <nq5t@tx.rr.com>
Subject: Re: [R-390] R-390A IF Module Layout

Orange Drops at AES -- http://www.tubesandmore.com -- are about the same prices they've always been, generally less than $1.00 each. I don't suppose "50 for $1.00" is a good description, but not exorbitant, all things considered.

eBay is just full of idiots. I have a big stash. I should offer them one at a time on eBay for $5.00 or more each and see how it goes ... but no, my stash is my stash, and I'm not parting with any of it :)

Date: Thu, 11 Dec 2008 21:02:09 -0600
From: Jerry K <w5kp@hughes.net>
Subject: Re: [R-390] R-390A IF Module Layout

Quoted from a Jan 2002 Chuck Rippel list posting: "Been watching this thread. First, do not perform a wholesale replacement of all the capacitors in the radio. The effort will not yield any inprovement. Beyond that, there are some, especially in extremely low value components in the RF deck, that are clearly installed with lead dress considerations in mind.On the www site, there is a compendium of the usual suspects when it comes to bad caps: http://www.r390a.com/ProbCaps.html Chuck Rippel, WA4HHG"

The link is still good, I just checked it.

Date: Thu, 11 Dec 2008 21:06:02 -0600
From: "Tisha Hayes" <tisha.hayes@gmail.com>
Subject: [R-390] Audio-Nuts and Capacitors

The only time I went the Epay route with orange drops was when I bought five
pounds of >600 Volt caps. I ended up with a pretty good mix of 715 and 716P's but I was still short of the values that you really use in restorations (.01, .1 uFd). For those I did go the Mouser route (great folks to do business with especially if you have a commercial account).

I was ambivelent to the audio-nuts and had a big laugh when I saw that one of their "preferred" caps was the black beauty because it has a "warmer" sound. I was tempted to sell em by the hundreds but I probably couldn't find 10% of the BBOD's that were not split or terribly leaky. Then, as a seller, you would get all sorts of negative feedback (pun intended with the audio-nut crowd).

Date: Thu, 11 Dec 2008 20:11:16 -0800
From: "Craig C. Heaton" <wd8kdg@worldnet.att.net>
Subject: RE: [R-390] R-390A IF Module Layout

There have been discussions about capacitor on this list before, some quite heated. Members have left over this topic. So here goes anyhow. Nomex is the uniform of this moment. Seems to be two camps: Those who don't replace caps, maybe their r-390's are on pedestals and are never plugged into an electrical outlet. So be it. Camp two replaces known trouble makers and use their receivers to listen to SW or maybe paired with a transmitter on the ham bands.
Dick: here is my list #1. This is where I start

PANEL & FRAME

QUANTITY	PART #	DESCRIPTION	NOTES	REPLACEMENT PART #
1	C101	PAPER	220,000pF, 100 WVDC, 20%	715P
1	C103	ELECTROLYTIC	50uF, 50 WVDC, (1)	

RF AMPLIFIER SUB-CHASSIS
QUANTITY
1 C227 PAPER 47,000pF, 100 WVDC 20% (7) 715P
1 C256 PAPER 0.1uF, 200 WVDC, 10% 715P
1 C275 PAPER 0.033uF, 300 WVDC, 20% 715P
1 C309 PAPER 0.1Uf, 200 WVDC, 10%

IF AMPLIFIER SUB-CHASSIS
QUANTITY
1 C504 PAPER 0.1uF, 200 WVDC, 10% 715P
1 C505 PAPER 0.1uF, 200 WVDC, 10% 715P
1 C517 PAPER 0.1uF, 200 WVDC, 10% 715P
1 C521 PAPER 0.1uF, 200 WVDC, 10% 715P
1 C528 PAPER 0.1uF, 200 WVDC, 10% 715P
1 C529 PAPER 0.033uF, 300 WVDC, 20% 715P
1 C531 PAPER 0.1uF, 200 WVDC, 10% 715P
1 C533 PAPER 0.033uF, 300 WVDC, 20% 715P
1 C534 PAPER 0.033uF, 300 WVDC, 20% 715P
1 C536 PAPER 0.1uF, 100 WVDC, 20% 715P
1 C538 PAPER 0.1 uF, 200 WVDC, 10% 715P
1 C541 PAPER 0.033uF, 300 WVDC, 20% 715P
1 C543 PAPER 0.1uF, 200 WVDC, 10% 715P
1 C545 PAPER 0.033uF, 300 WVDC, 20% 715P
1 C547 PAPER 0.1uF, 200 WVDC, 10% 715P
1 C548 PAPER 0.1uF, 200 WVDC, 10% 715P
1 C549 PAPER 10,000pF, 300 WVDC, 20% 715P
1 C551 PAPER 2uF, 500 WVDC, 10% (2) NTE
MLR205K6301 C553 PAPER 10,000pF, 300 WVDC, 20% (3)
715P

AF AMPLIFIER SUB-CHASSIS
QUANTITY
1 C601 PAPER 10,000pF, 300 WVDC, 20% 715P
1 C602 PAPER 0.033uF, 300 WVDC, 20% 715P
1 C603 ELECTROLYTIC 3 SECTION 30uF, 300 WVDC,
(4) 33uf @ 350V 140-XRL350V33 Xicon
1 C604 PAPER 10,000pF, 300 WVDC, 20% (5)
0.022uF Better Audio 715P
1 C605 PAPER 10,000pF, 300 WVDC, 20% (5)
0.022uF Better Audio 715P
1 C606 ELECTROLYTIC 2 SECTION 45uF, 300 WVDC
(4) 47uf @ 350V 140-XRL350V47Xicon
1 C607 PAPER 10,000pF, 300 WVDC, 20% 715P

1 C608 PAPER 10,000pF, 300 WVDC, 20% 715P
1 C609 ELECTROLYTIC 8uF, 30WVDC (6)

(1) This is the bathtub style capacitor mounted below the line filter on the rear panel. It is NOT an oil filled paper cap even though it looks like one. Watch the polarity.

(2) Oil filled metal can paper capacitor mounted to topside of chassis next to chassis harness connector. The NTE part number (Mylar film) is one, which will fit inside of the metal can.

(3) Blocking cap for mechanical filters. Recommend working voltage of 600VDC or higher to help decrease the chance of frying the mechanical filters due to failure of C553. This is not a good location to use a cheap replacement capacitor.

(4) The Xicon part number is one, which will fit inside of the metal can.

(5) For improved audio performance, you can use 0.022uF caps at this location.

(6) Also known as “the capacitor that rots off”. Leaks sulfuric acid when the seal fails. Watch the polarity when replacing.

(7) Stud mounted capacitor next to 6DC6 (V201)

RULE NUMBER ONE: “This is your radio, your money, and your time”
RULE NUMBER TWO: “Read rule number one”

The above list contains most of not all the capacitors that have been know to fail most often on the R390/A. Black Beauties of Death, Brown Beauties of Death, Aerovox, West-Cap and Vitamin Q are included in the list. There could be others!

Use the list according to which side of the fence you stand, or if sitting on the fence. In the event you own a museum piece, will never plug the receiver into a power receptacle and it will always be kept on a pedestal, the list is for your reading amusement only. For the capacitor replacers, the list is a good place to start. The 715P polypropylene film style of orange drop capacitors has a good track record. I’ve used the NTE and Xicon caps with good results as noted.

Yes other caps will work, read rule number one and two for all disagreements.

Date: Thu, 11 Dec 2008 20:44:25 -0800

From: "Craig C. Heaton" <wd8kdg@worldnet.att.net>
Subject: RE: [R-390] R-390A IF Module Layout

Capacitors Part 2

I use a Dremel tool to work on several of the caps. The two cans on the power supple module; I cut the rolled edge off of the cans. Then use a small torch to heat the cans to loosen the black uckumpucky and pull the guts out of the cans. New electrolytic caps go inside.

The bathtub cap on the inside of the back panel; once again use the Dremel tool with a cutoff wheel, on the bottom slit three sides and open like a sardine can. Insert a new electrolytic cap. Bend the flap back in place, add a dab or two of solder on the corners.

The "cap that rots" on the audio board is a wet tantalum, expensive! A solid dry tantalum is cheaper, works good, lasts long time. Mouser has them and orange drops,etc.

The 2uF oil paper cap on the IF module, no PCB's. Once again the NTE will either fit inside or on the bottom of the chassis. Dremel tool once again to cut the square metal can open and stuff in a new cap.

The R-390/A (s) that I've rebuilt: BBOD's were shot! On my Sprague TO-6A capacitor analyzer, BBOD's tested bad for value & insulation resistance. Electrolytic caps were leaky!

I try to use the R-390/A (s) just about every day, and they work.

Caps that will drive you crazy! The silver micas have given me the most problems. The cap analyzer shows they are good, but circuit doesn't work. Resistors are close to listed values, tubes are fine, replaced with new tubes, circuit still doesn't work. In this case, check the parts list and if there is a silver mica in there, shotgun it. Replace everyone in that circuit.

Places where silver micas have failed me: RF cans, when peaking the RF cans and the slug adjustment peaks just before the slug falls out of the rack, good chance one or more of the silver micas are bad in that coil assemble. Note the amount of signal needed to peak that rack compared to the other racks. If the RF cans are in good conditions, each rack should use just about the same amount of drive from the signal generator.

And last, a couple months ago the silver micas in the 200KC crystal calibrator drove me up the wall. Had to replace all of them, a couple of resistors, and the darned Amelco wanted the 200KC crystal from my Motorola..#$^%^&^& The Motorola was happy with any 200KC crystal.

Are we having fun yet?

Date: Fri, 12 Dec 2008 04:00:33 -0500
From: Roy Morgan <k1lky@earthlink.net>
Subject: Re: [R-390] R-390A IF Module Layout

> Side note: Too bad the Audiophools have latched on to
OD's.....

Forget Orange Drops. Use any modern film cap that is close to the right value. You don't need an assortment, you only need what you need. Poke into the parts lists and make up an order. Get good caps cheap at: www.justradios.com

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Date: Fri, 12 Dec 2008 07:33:49 -0600
From: "Barry" <n4buq@knology.net>
Subject: Re: [R-390] R-390A IF Module Layout

> Get good caps cheap at: www.justradios.com

Good advice. I recapped my last one with these type of caps (axial leads). It was quite a bit easier to fit these into their respective locations and worked just fine.

Date: Fri, 12 Dec 2008 07:51:30 -0600
From: "Cecil Acuff" <chacuff@cableone.net>
Subject: Re: [R-390] R-390A IF Module Layout

Actually there are three camps. Those that replace all BBOD caps regardless because if they are not bad now (that's rare), they will be. This has little to do with whether the radio has been out in the weather as part of the SJC pile or not.

I've seen probably 80% split and the remainder exceed leakage specifications. (I keep all removed components of radio restorations in large empty Biscotti containers for conversation pieces....) It's a personal thing and I don't think anybody should be beat up for residing in any one of the three camps. I do believe camp 2 should be the minimum one should do because of the issue with potential damage to the mechanical filters.

Date: Fri, 12 Dec 2008 12:05:00 -0500
From: rbethman <rbethman@comcast.net>
Subject: Re: [R-390] R-390A IF Module Layout

Cecil HAS hit it on the head! BBODs are bad news "bears"! *IF* one or more "somehow" passes the tests, exhibiting MIRACULOUS behavior, it

will bite you *IF* you use the radio. If it doesn't take out a filter,, it may take out an IF can or some other hard to impossible to find component.

These animals, "R-390s or R-390As", can be hard enough to get back to proper working order depending upon the state when acquired. Why needlessly suffer or spend $$$ needlessly? I've had ONE in great working condition that I recapped, and am currently working on the restoration of a St. J's survivor. I've already had to locate and procure two cans on the IF Deck. I want to tell you it was NOT easy NOR cheap! So the caps are being changed as I go!

Date: Fri, 12 Dec 2008 14:30:39 -0500
From: "Tim Shoppa" <tshoppa@wmata.com>
Subject: Re: [R-390] R-390A IF Module Layout

OK, that's the rhetoric, the reality is:

1. The vast majority of BBOD's in a 390A are used in filmanent bypass or cathode bypass where massive leakage, a thousand times or a million times bigger than the spec, will make NO DIFFERENCE AT ALL because the cap is used at some puny low voltage and even if it was leaking it couldn't do anything bad anyway because there's no way it's going to have an impedance lower than the DC resistances of the circuits involved.

2. C553 was never a BBOD in any IF deck I ever saw. It was always a high-quality metal-can cap.

All this evil gets assigned to BBOD's, and there's no shortage of BBOD's, I understand that folks like recapping (done it myself, I think that anyone is justified to replace the half-century-old Vitamin Q at C553 with a modern high-quality cap), but the BBOD's are getting blamed for evils that they cannot possibly be causing.

Date: Fri, 12 Dec 2008 16:47:00 -0600
From: "Cecil Acuff" <chacuff@cableone.net>
Subject: Re: [R-390] R-390A IF Module Layout

Tim that's the personal reality you are comfortable with....and that's OK if that's how you choose to go about the care and use of the radio's you own. (But should not be offered as the Gold Standard of realities). The facts are that the leakage on the bypass caps is cumulative and results in additional power supply load. A few milliamps here and a few milliamps there and it adds up. The caps would not be in the circuit if they were not necessary.

Does a split down the side paper cap with 2 or 3 ma of leakage current bypass as it was designed to? I would guess probably not...and that's

assuming it has retained it's capacitance value...and my tests indicates that many don't. As coupling/blocking caps the leakage is certainly performance affecting and many times damaging. I don't remember a claim that C553 was a BBOD, only that it is a documented problem area whatever type of cap design is installed there. I think we all agree, with the dimishing availability of replacements, the mechanical filters should be protected at all cost.

I've seen many positive performance changes with the replacement of leaky
paper caps. Enough that my personal reality is that I can easily justify the replacement of them in my radio's....Hammarlund, Hallicrafters, National and the R-390A's. (it's pure torture to recap an SX-28A). All the old paper caps have documented failure issues with the brown and black plastic ones being the most common offenders in the R-390A (the evil you mention) but even the metal types with glass seals fail as evidenced by the stories of fried IF filter coils. One just has to decide what level of risk tolerance they have as to what camp they choose to pitch their tent in. As for personal realities...those change over time with life's experiences. (at least mine have....I'm raising two teenage kids...HA!)

Date: Sat, 13 Dec 2008 23:33:11 -0500
From: Roy Morgan <k1lky@earthlink.net>
Subject: Re: [R-390] R-390A cap replacement from Vol 56, Issue 28

> ... would like to know of a good source to obtain them from.

"Orange Drops" by Sprague, Inc. are not needed. Get good caps of all sorts and good resistors of many sorts at: justradios.com These folks are in Canada and are a treat do deal with.. Good stuff, good prices, excellent service and friendly!

Date: Mon, 15 Dec 2008 17:56:57 +1300
From: ken <igloo99nz@yahoo.co.nz>
Subject: [R-390] The OD discussion

I've been reading with interest the discussion about recapping and the use of 'Orange Drops'. I bought a bunch of the 716 series from AE a while ago (enough to do a full recap on one R-390A) and I bought enough silver mica caps from Mouser to do an IF strip rebuild.

The reason I chose those particular types is what I perceived as their reputation for quality and reliability and as one list member said...I only want to rebuild/remanufacture my radio once! It's not going to be a museum piece, it's going to be a radio that I want to use on the daily basis for the rest of my life.

Having said that though...do you guys think I have gone overboard with my choices (716 series Orange Drops and Silvered Mica) as I've read that ceramics seem to be good enough to use almost everywhere. The reason that I didn't choose ceramics is that I read somewhere that the silvered mica were a step up from the ceramics.

I have a further three R-390 series radios that are going to get the full rebuild treatment so if there is a better choice out there I'd like to know. The radio I'm am doing at the moment is my first R-390A rebuild and I am planning on doing one a year...then I can sit back and relax and enjoy the fruits of my labors!

Date: Mon, 15 Dec 2008 09:22:54 -0600
From: "Tisha Hayes" <tisha.hayes@gmail.com>
Subject: [R-390] The OD dicussion

With infinite resources, time and room to mount them, the 715/716P caps of the 600-1000 V persuasion would be a a great idea. But, there are places where that level of performance is just not needed and can easily be handled with a ceramic disk. Silver Mica's are good capacitors with only a few that stray from the flock with time. Also all of the pF type caps would not be candidates for wholesale replacement unless there is a leakage/ stability/ performance or adjustment limitation by a slightly out of spec component.

There are some areas where the Vishay / Sprague 715 and 716P caps would really made a difference. With some capacitance changes in the audio string (read Chuck's quick and dirty audio mods for specific caps to change and what you can change the values to), the deadly filter killer cap (numero-Uno necessity to change), acid leaking caps on the audio deck, and maybe some changes to impove AGC performance (another well documented mod).

Don't forget the electrolytics that you would either re-stuff, buy re-stuffed caps or find a new replacement for on the audio deck. These are really important to do, but are not Vishay/ Sprague Orange Drop solutions. All told, you may end up replacing a 12-18 caps depending on how far you want to go on mods and on "gold plating" your receiver. Beyond that point and it will become a process of replacing good caps with more good caps and soon, once you run out of room, if you pulled back the cover you would see nothing but orange from all of the capacitors you had to hide into every corner.

Date: Mon, 15 Dec 2008 08:02:03 -0800
From: "Craig C. Heaton" <wd8kdg@worldnet.att.net>

Subject: RE: [R-390] The OD discussion (Dead Horse Walking)

For those who haven't been on this list, once again the capacitor question has appeared numerous times. It is a dead horse walking and needs to be beaten once more. Go back into the archives and check out previous post, some great reading on the subject of; if you recap, the need to recap, don't recap, etc.

So: Rule #1: It's your radio, your money, your time spent.
Rule #2: Read Rule #1.

My money is to replace BBOD's with orange drops, they have a proven track record. I'd like my receivers to outlast me. And this should be rather easy, I've more to look back on than time will give me for the future. Since the R-390/A is belly up, might as will replace the electrolytic caps at this time. Then plug it in. As final food for thought we will resurrect dead horse #2, the R-390 (non A). This fine radio was the predecessor of the R-390/A. In the early 1950's the non A was deemed costly to produce and needed a few improvements. Please read the following link, Cost reduction program for radio receivers R390/R391/URR. Please note on page 6 of this document, third paragraph, "In the field of components, capacitors in particular proved quite costly." http://www.r-390a.net/faq-refs.htm

For some reason, the engineers which designed our beloved R-390/A chose not to use ceramic disc caps for bypassing, etc. There has to be a reason why it has such a large following and is thought to be the best vacuum tube receiver built!

Date: Mon, 15 Dec 2008 11:44:16 -0600
From: "Don Reaves" <don@reatek.com>
Subject: RE: [R-390] The OD discussion (Dead Horse Walking)

> For some reason, the engineers which designed our beloved
> R-390/A chose not to use ceramic disc caps for bypassing,
> etc. There has to be a reason why it has such a large ...

I've always wondered if the original designers had Sprague ODs commonly available to them at the time if they would have specified them in the receiver. My hunch is they would have, where appropriate. Most of the 40 to 50 year old electronics that get a bit of time on my workbench have bad caps. Rarely do I find a bad tube, and most resistors are only slightly out of tolerance unless they have overheated. So, Mouser and the other capacitor vendors are bookmarked for frequent orders.

I just ordered a few original style Mallory FP twist-lock electrolytics

offered by tubesandmore.com. These are new, not new old stock, and built with the original Mallory equipment that tubesandmore purchased. These should be drop in replacements for my 75A-4, 75S-3, and 51S-1. All three of these receivers have developed moderate hum and I don't want to risk destroying the power transformers, and they offer a 10% December discount on orders. Unfortunately they don't stock a new plug-in type as used in the R-390A.

The capacitor thread periodically erupts, and some folks take them way too seriously. Remember we need a civil discourse here; there is no need to don the asbestos suits yet again.

Date: Mon, 15 Dec 2008 12:23:17 -0600
From: "Jerry Boman" <mdg11fbf@gmail.com>
Subject: [R-390] Re: capacitor choices

After checking out the sources for caps provided by fellow members and reading some recent posts concerning cap choices by Ken in vol 56 Issue 33 & Don in vol 56 Issue 31 I find myself slightly unsure which caps are the absolute best to use for recapping. After checking the available caps and the prices for them and considering the time involved with doing the actual job of recapping I would much prefer to use the absolute best caps I can and find the prices to be minimal compared to the value of the equipment being serviced. So, I must ask all you pros who have done many radios...What are the absolute best caps to use if the price of them is not a determining factor in the choice?. Thanks in advance for your inputs, Jerry (newcomer testing for license in 1/09)

Date: Mon, 15 Dec 2008 14:08:57 EST
From: Flowertime01@wmconnect.com
Subject: Re: [R-390] The OD discussion (Dead Horse Walking)

> For some reason, the engineers which designed our beloved
> R-390/A chose not to use ceramic disc caps for bypassing, etc.

The year had something to do with it.
Ceramic disc with mil spec ratings were not yet in existence.
I am not sure Ceramic disc caps even existed in 1950.

Date: Mon, 15 Dec 2008 14:49:54 -0500
From: rbethman <rbethman@comcast.net>
Subject: Re: [R-390] The OD discussion (Dead Horse Walking)

Since I was born in 1950, I have NO clue what was or was not available. I've received E-mail regarding "rhetoric" on BBODs. I replied directly. The specific response was that I attempted to replace all BBODs EXCEPT for

the bypass ones in an SX-101A. Guess what? This cost me a mixer transformer and stage. Smart wiseman with 20/20 hindsight: Get RID of them!

Date: Mon, 15 Dec 2008 12:02:11 -0800
From: "Craig C. Heaton" <wd8kdg@worldnet.att.net>
Subject: RE: [R-390] The OD discussion (Dead Horse Walking)

Good to hear you chime in! Been waiting for one of the list experts. So, now I'm really a cornfused West Virginian. Had to go out to the garage and flip over a bare bones IF module. It has some disc caps in it, think I recall some disc in the RF section too. Any idea as to what type of disc? Guess I could dig out my Y2K, scroll down the parts list and google the mil number if there is one listed. At this point, I'll look and see where the Collins guru's used the disc, review of section 5 and 7 for homework tonight. Once again, Roger, thanks for the info.

Date: Mon, 15 Dec 2008 15:34:19 -0600
From: Robert Nickels <ranickel@comcast.net>
Subject: [R-390] Capacitor Question

I know that Tom at Hayseed Hamfest has a created a prototype of a replacement plug-in cap for the R-390, 51-J4, etc. and is thinking about going into production with it. He showed me a pic of it at www.hayseedhamfest.com/plugcap.jpg The one in the picture has eight pins, but he said any production units could go either way, 4 or 8. It seems to me it is bigger in diameter than original, like 1.5", and he wasn't sure if that would create problems with clamps, clearance, etc. I would suggest contacting him through his website: www.hayseedhamfest.com with any comments you may wish to pass along.

Date: Mon, 15 Dec 2008 15:40:28 -0600
From: "Barry" <n4buq@knology.net>
Subject: [R-390] Hayseed Hamfest stuff

Maybe he could make one of these for the R390/R390A.
http://www.hayseedhamfest.com/overlay.htm

Date: Mon, 15 Dec 2008 18:03:28 -0500
From: "Dave Maples" <dsmaples@comcast.net>
Subject: RE: [R-390] Another comment on OD?s

All: For what it's worth, I use the polyprop. caps from Illinois Capacitor available at Antique Electronics Supply. They are true axial-lead caps, slightly smaller than the ODs, and still made here. More flames if needed...

Date: Tue, 16 Dec 2008 09:16:06 -0500
From: Roy Morgan <k1lky@earthlink.net>
Subject: Re: [R-390] The OD discussion (Dead Horse Walking)
>
> ... I came away with no real definitive answer other than the Orange
> Drops seemed to be favoured by many in the group.

One thing is for sure in MY mind: there is no real sure answer. It's a matter of opinion. If you choose to use Orange Drop (registered trademark) from Sprague,and I use ICM or some other caps made overseas, and we put the two radios to operate side by side, I'll BET YOU YOUR RADIO that something else will fail before any cap we've used. That's my story and I'm sticking with it.

Date: Tue, 16 Dec 2008 10:40:20 -0600
From: Robert Nickels <ranickel@comcast.net>
Subject: Re: [R-390] The OD discussion (Dead Horse Walking)

Certainly a safe bet Roy. And maybe this is a good time to toss out my favorite source for quality capacitors at great prices:

http://www.radioantiques.com/supplies.html

Bob is an antique radio buff who just tries to help fellow hobbyists.

Date: Tue, 16 Dec 2008 20:01:53 +1300
From: ken <igloo99nz@yahoo.co.nz>
Subject: Re: [R-390] The OD discussion

That's a good post...so now I have decided to add disk ceramics to the mix and use them at all the bypass positions. I have an EAC unit that uses disk ceramics and some of them are leaky, but I would assume that modern manufacturing techniques would mean that ceramics of today are far superior to ceramics of yesterday.

Date: Wed, 17 Dec 2008 17:33:10 +1300
From: ken <igloo99nz@yahoo.co.nz>
Subject: Re: [R-390] The OD discussion

>.....know more about these leaky ceramic caps you found.....

Sorry Roy, my apologies...I was thinking of something entirely different. I reboxed that particular radio to keep dirt, dust and anything else out of it while it sat here awaiting restoration. From memory it has two obvious faults... Low sensitivity below 8mhz and distorted audio with the noise limiter turned off with noticable improvement when turned on to 'one'. The ceramics aren't at fault, I just had a brain meltdown...sorry...I should have checked my facts before I posted.

Date: Wed, 17 Dec 2008 12:42:35 -0500
From: Roy Morgan <k1lky@earthlink.net>
Subject: Re: [R-390] The OD discussion

>>> ...Disk Ceramics and some of them are leaky,
>> That's very odd. ...
> Disk ceramics have been known to absorb water after long periods of
> immersion, and can be leaky afterwards;

That makes good sense. Turns out, he was thinking of something else when he wrote that and does not actually have leaky ceramic caps. But I'm glad to hear what might cause them. I have an SP-600 chassis here that is a flood victim. Immersed for some time at least a a few inches deep. I think that chassis is going to be a parts donor, but with enough work it might run again. it has black tubulars in it though.

Date: Tue, 30 Dec 2008 15:36:21 +1100
From: "Bernard nicholson " <vk2abn@bigpond.net.au>
Subject: [R-390] RA17 receivers

Gentlmen please excuse the off topic post But I did see someone making enquiries about RA17 Rx s A few months ago and I am aware that there is interest in these British Wadley Loop Receivers, this is a potted compendium of my experience with RA17 Rxs. Most problems I have encountered have been due to the disc ceramic caps that were used in these receivers that were manufactured from 1954 -1974,

Over the years, I have repaired around 50 of these Rxs. These are the caps that go faulty, They are very poorly made in comparison with modern capacitors. The failure mode is the plating onto the ceramic, the caps that cause the trouble are in the shunt tuning in the 37.5mHz & 40mHz filters, they are used also in the anode tuning in the 1MHZ crystal osc, and harmonic gen/low pass filter, when used as coupling caps between tuned circuits they also cause problems.

I replace with high stability ceramic or plastic/polystyrene. The caps I have had to change fom my RF workbook are:-

C21 , C33,C44,C54,C62, C71,C80,
C89, C75 C25,C36, C46, C56, C64,
C73, C82, C91,C121,C124,C150,C51,
C68,C50,C67,C42,C9, C3 C113, C143,
and C107, <snip>

Date: Wed, 31 Dec 2008 08:08:24 +1100

From: "Pete Williams" <jupete@bigpond.net.au>
Subject: [R-390] R-390 AGC/ Time constant

G'day...when does a capacitor become a battery? In trying to sort an obscure fault in a R-390/URR agc /TC problem in a IF module, I've discovered that the 2 mfd TC capacitor appears to be generating a 20+ mV charge that won't go away.

It's still there after standing still for hours and not affected after shorting--- the charge returns. Anyone else seen this?-Other 2 mfd caps don't show this effect.
Changing to see if the problem in the radio is still there yet to be done.

Date: Tue, 30 Dec 2008 16:54:35 -0500
From: "Tim Shoppa" <tshoppa@wmata.com>
Subject: Re: [R-390] R-390 AGC/ Time constant

It's called "soakage"
h:ttp://www.national.com/rap/Application/0,1570,28,00.html
I'm not sure 20mV itself is the cause of a problem in the AGC system, but the AGC system is an integrator and soakage means dielectric absorption can mess up integrators more than just their voltage offset. 20mV is pretty small for soakage. I'm used to old big oil filled capacitors which would "bite" (must be > 100V) after sitting on the shelf :-).

Date: Tue, 30 Dec 2008 15:57:13 -0600
From: Mike Andrews W5EGO <mikea@mikea.ath.cx>
Subject: Re: [R-390] R-390 AGC/ Time constant

Hi, Pete. This is a known effect, which leads makers of really big HV caps to short the terminals before shipping them. Not all caps do this, but some do. Would anyone be interested in reading the story that W9LBB posted to the Glowbugs list a few years back about the test facility at the VERY High Voltage cap. mfg. plant? I find it hilarious and scary at the same time, and very definitely educational. He mentions shorting the cap terminals before shipment as an aside, too.

Date: Tue, 30 Dec 2008 17:48:04 -0600
From: "Bill Hawkins" <bill@iaxs.net>
Subject: RE: [R-390] R-390 AGC/ Time constant

What are you using to measure this voltage? If you have a 100 megohm resistor, try measuring the millivolts across it. It could be the bias current of the DVM's amplifier. It takes .0002 microamps to develop 20 mv, and that's not unreasonable for an inexpensive meter. If it were just the cap, shorting it would reduce the voltage. And yet, you say that other caps

don't do it. When the cap is standing still, is it standing alone - not in the circuit? OK, if a 100 or 10 meg resistor across the cap doesn't lower the voltage, then you have some sort of thermocouple effect. See if refrigerating it changes anything.

Date: Wed, 31 Dec 2008 00:50:38 -0600
From: Gary Pewitt <n9zsv@magtel.com>
Subject: Re: [R-390] R-390 AGC/ Time constant

Please do post it. Sounds very interesting. Thanks Gary N9ZSV

Date: Wed, 31 Dec 2008 08:42:19 -0600
From: Mike Andrews W5EGO <mikea@mikea.ath.cx>
Subject: [R-390] (by request) W9LBB on Testing the HV Capacitor: a Cautionary Tale

>From the Glowbugs mailing list, a tale of a jobfh that makes being a mere sysadmin look _good_, fun, and above all _safe_:

: I dropped out of college for a couple of years (ran out of money)
: and went to work at a capacitor factory (which will remain unnamed
: to protect the guilty) as a Quality Control Tech on the production
: line.

: The owner of the place was a MSEE, and the company specialized in
: VERY high voltage capacitors, and high voltage power supplies. We
: made a VERY good product, but the production line testing techniques
: were, to say the least, hair raising; I saw more than one tech quit
: after one day on the job.

: Typical hipot test, on an 8 MFD, 5 KV capacitor; put it on a table
: with a grounded metal top. The tech grabs a pair of home built test
: prods, connected to a high voltage supply with a variac on it, and
: applies the prods to the cap terminals.

: Specs called for charging the cap to 10 KV and holding it there for
: 1 minute.

: If the cap doesn't fail, so far so good. If it fails, it does it in
: one of a couple of modes.

: The GOOD failure mode; there is a sharp metallic click inside of the
: can as the sections arc inside of the oil and discharge.

: The BAD failure mode; the solder seals blow and oil sprays all over
: the place!

: What made it interesting every day... before starting work, we
: checked a wet bulb / dry bulb thermometer and using it's readings
: computed the humidity. If it was over 75%, we spent the day working
: on small, low voltage stuff. If you tried to charge anything big,
: sure as hell it would flash over to ground with a sound like a 12
: gauge shotgun going off in your face!

: Most of the line techs were habitually on sedatives and antacids
: because of the fear factor... and the Old Man in the corner office
: insisted that 10 KV was TOTALLY safe, and we had NOTHING to worry
: about!

: Anyway... you now have a 5 KV cap sitting there charged to 10 KV.
: What do you do with it NOW?

: VERY simple, Grasshopper.... there is a THIRD home made test probe.

: This one is tied to a bank of resistors mounted on a sheet of
: plywood. You use it to discharge this nasty little beastie.

: Not all that simple, really... it's an art that it took a couple of
: weeks to learn.

: You approach the cap like you'd approach a cobra that you're trying
: to milk for venom. SLOWLY... CAREFULLY... you move in with the
: resistor probe. You DON'T move in too fast, or you get another
: chorus of the 12 gauge Remington Pump Sonata in your face as it ALL
: lets go at once, flashing over the resistor bank.

: If you've done it RIGHT... about 6 inches from the terminal there is
: a beautiful purple streamer to the end of your probe, and a faint
: hiss as the juice goes to ground thru the resistor bank.

: Once you have the dragon stuffed back in his cage, the FIRST thing
: you do is grab one of the MANY spools of uninsulated wire lying
: everywhere and your diagonal cutters, and slap a shorting wire
: across the monster... like RIGHT NOW!

: Hairy procedure all around.

: One day a new directive came around. There was a bottleneck in the
: plant on larger capacitors; they were piling up waiting for hipot
: testing. We had only ONE high voltage testing cage (it took caps
: up to 100 KV working!), so to increase production flow the Old Man
: in the Corner Office decreed that open air testing like I just

: described would now be done on caps up to 15 KVDC working... which
: meant using hand probes about a yard long to charge to 30 KV!

: Two guys muttered obscenities along with the words "I Quit!" and
: stalked out the door. The rest of us said "No Way, Jose", and told
: the owner so in no uncertain terms!

: He came around and told us we were all cowards, and told us
: something we hadn't known about him (and which explained a lot
: really)... he'd gotten the money to start his company in London
: at the end of WW2; he'd stayed after the war & worked at DEFUSING
: UNEXPLODED BOMBS for a living!

: HE decided he'd show us how to do it, and he wanted no more bitching
: from the production line!

: The old boy grabbed the probes and a 2 MFD, 15 KV cap and had at it
: himself. EVERYBODY backed up a few yards to watch as he hoisted this
: ten pound beast onto the table top.

: You never saw such an exhibition of arcing and sparking in your
: life! Repeated shotgun blasts as that cap arced to probes, across
: insulators, and even to the steel beams that held up the building!
: Yard long test probes proved to be a good bit more awkward to handle
: than he'd thought they were.

: He FINALLY got it to 30 KV... and then went in with the resistor
: bank probe.

: Sometimes you just live right, or at least lucky. Before he got the
: probe to it the cap failed... in the BAD mode!

: There was a muffled WHOOMP! and the entire top, six inch insulator
: and all, went flying into the air as the solder seals blew out!
: That was followed by a flying spray of mineral oil, and a billion
: bits of paper and aluminum foil as the capacitor sections shredded
: themselves. It was like a cherry bomb went off inside of that
: capacitor... absolutely BEAUTIFUL, and the Old Man was COVERED with
: the flying debris as most of us dove for cover!

: Gathering up as much of his tattered dignity as he could he wiped
: off his oily glasses, put them back on, and a badly shaken MSEE
: walked away without a single word.

: Within the hour a new directive came out returning us to the old
: open air testing limit of 5 KV caps.

: Sometimes all it takes to restore sanity is for theory to meet
: reality head on...

: Mr. T., W9LBB

Date: Tue, 20 Jan 2009 11:29:01 -0800 (PST)
From: wli <wli98122@yahoo.com>
Subject: Re: [R-390] Capacitor tip

Here is a tip re checking caps that we all once knew, but probably forgot.

Bypass caps can be checked in a live circuit with a scope. By checking the ungrounded lead of the capacitor in question, there should be no AF or RF signal. If there is anything, the cap is either open or its ground connection is open. Of course, a shorted bypass cap results in a loss of the normal DC voltage at that point.

Coupling caps should the exactly identical AF or RF signals present at both leads. A leaky one will show abnormal output voltages.

Date: Wed, 4 Mar 2009 20:54:05 -0800 (PST)
From: Steve Toth <stoth47@yahoo.com>
Subject: [R-390] question on "dogbone" ceramic caps

I'm troubleshooting the BFO circuit in my R388 - plate and screen voltages and resistances are off - and it uses ceramic dogbone caps as bypass capacitors for the plate and screen circuits. Do these stay fairly stable or are they prone to go leaky? I'm trying to figure out what parts I need to possibly replace in addition to the plate and screen resistors. Thanks.

Date: Thu, 05 Mar 2009 16:37:48 -0500
From: bonddaleena@aol.com
Subject: Re: [R-390] Dogbones

Hi. I have recapped several hundred radios and pieces of test equipment. I have only seen one shorted disc cap, and ZERO bad dogbones. All the wax, BBODs, etc, are usually SO bad (percentage wise), I usually do a wholesale replacement... Micas are a mixed blessing, so I usually test them, since the test only takes seconds.

Date: Thu, 5 Mar 2009 18:40:04 EST
From: RKofler@aol.com
Subject: Re: [R-390] Dogbones

How do you test the micas?

Date: Thu, 5 Mar 2009 20:19:44 -0500
From: Roy Morgan <k1lky@earthlink.net>
Subject: Re: [R-390] Dogbones

Not too long ago I had an SX-42 to overhaul. It uses a 3 pf cap as top coupling between tuned RF amp stages. It was shorted and had taken out the plate dropping resistor of the driving stage. (The coil in the grid of the next stage was grounded on one end.) I replaced all the small value dog bones in the set that were standing off B+.

Date: Sat, 14 Mar 2009 12:21:30 -0700 (PDT)
From: Perry Sandeen <sandeenpa@yahoo.com>
Subject: [R-390] Capacitor use

I believe that the correct use is disk caps for RF and orange drops for audio. I agree while it is best to use foil types I'm not sure that metalized foil caps the are Orange Drops from high quality mfr's.wouldn't be fine especialy if one upped the voltage rating. It does come down to a price issue for some.

Date: Tue, 17 Mar 2009 15:15:17 -0700 (PDT)
From: Perry Sandeen <sandeenpa@yahoo.com>
Subject: [R-390] Capacitor correction

I had a bad senior moment on my capacitor posting. Here is the corrected thought plus a past reflector post.

From: Chuck Rippel <wa4hhg@amsat.org
Date: Fri, 11 Dec 1998
Subject: Re: caps

Use polypropylene media Orange Drop capacitors for circuits operating at 455kc and below. If you want to be really fancy, bypass those with a .001 ceramic disk. I get my Orange Drops from Antique Radio: http://wwwtubesandmore.com

Use 1KV Ceramic discs for frequencies above 455KC

I believe that the correct use is disk caps for RF and orange drops for audio.

I agree while it is best to use foil types, I'm not sure that metalized foil caps that are of the orange drop style from a high quality Mfr. wouldn't be fine. Especially if one upped the voltage rating. It does come down to a

price issue for some.

Date: Thu, 11 Jun 2009 19:06:04 -0400
From: Jon Schlegel <ews265@rochester.rr.com>
Subject: [R-390] Part Value Discrepancy - C517

I found a part value difference on two different schematics for the R-390A. It's C517, the cathode bypass for V502 on the IF module. At least one schematic shows this value as 0.1uF while at least one other schematic shows this as 0.01uF. What's the consensus?

Date: Thu, 11 Jun 2009 19:20:09 -0400
From: rbethman <rbethman@comcast.net>
Subject: Re: [R-390] Part Value Discrepancy - C517

What I have shows C517 as being a 0.1uf.
That is also consistent with the Y2K manual.

Date: Fri, 12 Jun 2009 16:54:51 EDT
From: Flowertime01@wmconnect.com
Subject: Re: [R-390] Part Value Discrepancy - C517

It is only one of several typo's in the schematics. 0.1uf is in line with expected values. It is a bypass cap and their is no reason for an unexpectedly small value. Check in the next receiver you get a chance to look at and see what is installed.

Date: Tue, 08 Sep 2009 01:03:05 -0500
From: Steve Kent <steve.kent@att.net>
Subject: [R-390] Parts Needed, new R-390A owner & questions...

I am new to the R-390A world and have recently acquired a SW R-390A s/n 1911. I have wanted one of these receivers since I was a young boy, as my dad had one in the garage and I would tune around for hours. I always wanted one, and now that I have the space, I am working towards making this one functional. Anyway, I am looking for a few things. Here goes:

L505 12MH choke
T201 slug
Z213 center slug
Z205 rear slug
"IF Out" coaxial jumper

I wanted to be very cautious before powering it on, knowing that there are some caps with bad reputations. So I set out to give it a good once over and take a close look around. It's a good thing I did. Upon removing the

IF deck I discovered a blackened area with L505 fried and R508 blown up. C553 tests OK but I am replacing it; I expected it to be shorted. ..... <snip>

Date: Tue, 8 Sep 2009 09:53:18 -0400
From: Paul Anderson <paul@pdq.com>
Subject: Re: [R-390] Parts Needed, new R-390A owner & questions...

Hi Steve, welcome to the group! C553 doesn't short any more often than the others, it is just that if it does, it can fry your filters real quick, so replacing it is a good idea. <snip>

The other problem areas are the the big electrolytic audio caps, which will often hum or if they short, fry the audio transformers or they can leak, which makes a mess. The shorting problem seems like common than the other two. There is a small cap under the audio deck in the middle of the little circuit board that often goes bad and makes a mess - it is worth replacing that one too. As to the other caps, opinions vary, but one consensus is that wholesale replacement of the BBOD (black beauties of death) is worthwhile. It does depend on the age of the deck, past use, your time and how you value it, and so on. I replaced a bunch in I think two R-390A IF decks, and that was fine, but maybe in the future, I'd just replace C553, and leave it at that - test the deck and see how well it works before redoing it. Other R-39X radios (R-389, R-390, R-391, R-392) seem to have slightly better quality caps, but they also tend to be older (early to mid 50's for the 389/390/391). Later R-390A decks have much newer caps, and perhaps better manufacturing, but they are still paper caps, nonetheless.

I can't think of any other serious problems to watch out for, other than the usual common sense stuff - check resistors, they drift high often, due to heat (mind you also due to resoldering capacitors, so this is another incentive NOT to wholesale recap a deck). I've seen some crack just due to age or heat, too.

Date: Tue, 8 Sep 2009 17:45:12 EDT
From: Flowertime01@wmconnect.com
Subject: Re: [R-390] Parts Needed, new R-390A owner & questions...

Welcome to the group of owners. On the IF deck caps. Once you start you may as well do the whole deck. As long as you have to get some caps you mite as well get enough to do them all. Once you start getting the iron hot you may as well do them all. You do it once in the receiver and you are done with it for life. Do use a good 600 volt cap on the mechanical filters. It is just cheep insurance. Good 250 volt or better are OK else where in the receiver. Do change the 8 uf C609 cap in the audio deck. A larger value

helps. it only needs to be 30 volts or so. You do not need the high voltage model the military used to have a common in stock part. A 30 volt 10 or 20 uf works nice. There are a couple of BBOD under the RF deck. Someday you may want to change them. You should pull the RF deck at least once and do an inspection and overhaul.
Do change the BBOD under the RF deck.....<snip>.....

The BBOD are 0.1uf and 0.05 uf (5000 PF) once you start putting in new caps two things happen.

There is a lot more room under the deck. You find shorter closer points to ground the caps to. Along the way unbolt and rebolt the ground lug hardware. This just cleans up any crud under the ground points and gets you a good mechanical connection for the next 50 years. Once you start the process, you quit wondering and just know you are going down the right path of least resistance as a once in a life time experience. You should be able to recap the whole IF deck in a weekend. Think $15.00 in parts. 10 hours plus at 25.00 an hour and know you just about double the value of the receiver with just the labor dollars you have in the receiver.
..... <snip>.....

Date: Sat, 07 Nov 2009 18:03:24 -0500
From: K3DX <k3dxLab@comcast.net>
Subject: [R-390] Polarity of Axial Electrolytics

A boatload of parts just arrived from Mouser! Now the fun begins, refurbishing my two R-390As, and misc. other electronics and test equipment. I though I'd start with the RCA VoltOhmyst. I grabbed a new 10mF electrolytic, and, and.... which end is positive? There is a stripe with minus signs running the entire length of the cap. So I guess this means that the can is negative? That's usually the case, but the markings on this Xicon don't seem clear to me. I was expecting +++ or --- at one end. This does have axial leads, after all. Soooo, is the can the negative end? thanks, Dave - K3DX

Date: Sat, 7 Nov 2009 19:04:05 -0500
From: "Al Parker" <anchor@ec.rr.com>
Subject: Re: [R-390] Polarity of Axial Electrolytics

Does that stripe with the minus signs have an arrow? If so, it points to the negative end.

Date: Sat, 07 Nov 2009 21:02:32 -0500
From: K3DX <k3dxLab@comcast.net>
Subject: Re: [R-390] Polarity of Axial Electrolytics

Thanks for all the responses. I forgot about the arrows pointing to the negative end. But these 10 mF 250v caps have NO arrow! So I grabbed two other packs of Xircon axial 'lytics that I have, and... they have arrows! This looks like a manufacturing error to me. Someone applied the labels for radial caps to the axial caps. No problem. Mouser only has 9,600 of 'em ;-) Guess I shuda bot the Sprague capacitors. They only cost 3x.

Date: Mon, 6 Sep 2010 22:48:32 -0500
From: <ka9egw@britewerkz.com>
Subject: [R-390] The saga cont pt 4 and C556 and fake caps

Forwarded below is the last of a thread on another group about counterfeit caps. I sure don't want to risk my filters by using a knockoff for replacing the filter-killer cap. So todays question is where do you guys go to buy your parts when it's time to re-cap? With The Radio-TV Lab [Chicago] QRT, I need a neew source.

Date: Tue, 07 Sep 2010 03:16:15 -0400
From: Jeff Adams <physicist@cox.net>
Subject: Re: [R-390] The saga cont pt 4 and C556 and fake caps

I find Digikey or Mouser are good for small quantities.

Date: Tue, 7 Sep 2010 07:07:09 -0500
From: "Cecil Acuff" <chacuff@cableone.net>
Subject: Re: [R-390] The saga cont pt 4 and C556 and fake caps

Allied or Mouser... Usually orange drops here...

Date: Tue, 7 Sep 2010 11:40:11 -0400
From: "Shoppa, Tim" <tshoppa@wmata.com>
Subject: Re: [R-390] The saga cont pt 4 and C556 and fake caps

Counterfeit Asian electrolytic caps have been a problem for most of the past decade in the PC world... but I don't see what that has to do with 390A caps. The counterfeiters are not aiming at the 390A market, they are aiming at the PC-clone market (e.g. super subminiature low-ESD low voltage lytics). And as to buying from "group members" vs "auction sites"... what's wrong with official distributors? E.g. all the trusted old names... Newark, Allied, Mouser, Digikey. They sell both American and Asian caps, and since the counterfeit electrolytic disaster the whole official distribution chain has increased security.

Date: Tue, 7 Sep 2010 11:23:43 -0500
From: Tisha Hayes <tisha.hayes@gmail.com>
Subject: [R-390] Fake Caps

I bought an electronic suppliers inventory of Sprague Orange Drops by the pound (+20 lbs of capacitors). There are just so many places you can squeeze in a 0.1 uFd 600 V capacitor. The nearest we have as a rotten cap is that 8 uFd cap in the audio deck that leaks acid. Of course, finding an 8 uFd capacitor is a challenge and I usually go with an 8.2 uFd at a higher voltage rating and squeeze it inside the audio deck with longer leads covered in teflon spaghetti.

Since I also do SP-600's I replace a bunch of 10 uFd bathtub capacitors on the B+ string. I see a bunch of those SMD mounted caps that are programmed for destruction in Motorola Spectra control heads and microprocessor boards. To replace those I use a hot air station and desoldering wick.

What bothers me is that I do not know for certain that the SMD caps I am putting back into the Spectras are any better than what I am taking out. Maybe I am just resetting the 10 year time bomb. In the SP-600's it is the BBOD's (black beauties of death) where there are 25-30 of those things hidden all over the radio. At the same time I replace the paper caps and also up-cap the B+ supply to reduce ripple.

In the R-390A I do not know how many folks replace the octal plugged B+ caps on the audio deck. Even getting a 40 year old NOS capacitor is not the same as buying a brand new-new capacitor. Those are prime candidates for restuffing.

TTY'all later, I need to catch a flight to San Jose.

Date: Tue, 7 Sep 2010 12:55:26 -0400
From: "Shoppa, Tim" <tshoppa@wmata.com>
Subject: Re: [R-390] Fake Caps

On the subject of fake and counterfeit modern parts, IEEE Spectrum notes some of the more recent issues and how they ripple up and down the entire supply chain at:
http://spectrum.ieee.org/computing/hardware/bogus/0

Dell's reputation is particularly hurt, see this article, "How a stolen capacitor formula ended up costing Dell $300M":

http://www.guardian.co.uk/technology/blog/2010/jun/29/dell-problems-capacitors

And finally I'd like to note that while the above articles treat the issue as new, I know it isn't. A half century ago the counterfeiters were called

"Tube washers", and they'd buy used or cheap below-spec tubes, remove the markings, and relabel them with part numbers that were most desirable. They could kinda work for some not-critical applications.

And the military/aviation supply chain is still reeling from fake mislabeled fasteners. This article is from 2007 but really the problem has been around since at least the 70's (although putting the blame on globalization, that's the latest twist):

http://www.verical.com/about/resources/docs/032808_AirForce_FAKE_PARTS_ARE_SEEPING_INTO_MILITARY_AIRCRAFT_MAINTENANCE_DEPOTS.pdf

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Date: Tue, 7 Sep 2010 21:42:14 -0700
From: "Greg Werstiuk" <greg_werstiuk@msn.com>
Subject: Re: [R-390] Fake Caps

The Dell capacitor issue was not one of a fake or counterfeit product but rather one where Dell (and other companies) chose to use the lowest cost parts available from companies which in turn were buying their electrolyte from a new source.

That electrolyte supplier was providing a poorly formulated product.

Everything went down hill from there. Up until that point, the capacitors from those companies were probably acceptable.

Date: Tue, 7 Sep 2010 23:58:00 -0500
From: "LEE BAHR" <pulsarxp@embarqmail.com>
Subject: Re: [R-390] Fake Caps

I put in a graphics card and an audio card into a new Dell computer I purchased a little over a two years ago. Over time, both graphics and audio cards blew the tops off all the electrolytics on those boards. I had exact replacement boards as I was about to build up another computer. I used these spares as replacements and now a good year later, they are still functioning with no problem.

I bought the cards from New Egg and they were middle of the road in price. What is sad is the boards had a one year warranty but when I read the warranty you needed to send the mfg everything even the original box the board was within. Of course I no longer had the box. Why all the caps blew on both boards at different times is not understood. Since both replacements have been in the computer a long time, I don't believe the power supply was at fault. Strange.

Date: Wed, 8 Sep 2010 10:17:33 -0500 (CDT)
From: Jim Haynes <jhhaynes@earthlink.net>
Subject: Re: [R-390] Fake Caps

Apropos of all this, there is a guy in Missouri who does business as www.badcaps.net who sells replacement capacitor kits for computer motherboards, or does the replacement job for you. I've used him a couple of times and am very pleased with his work.

Date: Sat, 11 Sep 2010 14:04:05 -0700
From: "Craig C Heaton" <wd8kdg@att.net>
Subject: Re: [R-390] The saga cont pt 6 pleasant surprise

BBOD's????

Date: Sat, 11 Sep 2010 16:11:58 -0500
From: "Cecil Acuff" <chacuff@cableone.net>
Subject: Re: [R-390] The saga cont pt 6 pleasant surprise

Yup..they all need to go. Pull a couple and check the leakage at rated voltage. I haven't found a good one yet....still looking though.

Date: Sat, 11 Sep 2010 14:35:42 -0700
From: "Craig C Heaton" <wd8kdg@att.net>
Subject: Re: [R-390] The saga cont pt 6 pleasant surprise

BBOD can also relate to Brown Beauties of Death! Bumble Stripes on these lovely old caps. Close inspection with a magnifying glass will show cracks where the epoxy covering has shrunk and crushed the foil/paper inside. By memory, three in the RF deck, maybe 2 dozen in the IF.....

Date: Sat, 11 Sep 2010 17:52:04 -0400
From: rbethman <rbethman@comcast.net>
Subject: Re: [R-390] The saga cont pt 6 pleasant surprise

The Brown Tubulars are the same thing as the BBODs! They must be replaced!

Date: Sat, 11 Sep 2010 16:27:05 -0500
From: <ka9egw@britewerkz.com>
Subject: Re: [R-390] The saga cont pt 6 pleasant surprise

To be quite honest, I'm not sure if therer are any "Black Beauties Of Death" in this radio; all the caps under the IF deck, for example are either yellow AVX film caps or light green silver micas with the value stamped in plain text [not the old dot code SM's], or brown tubulars. I'm guessing it's a very

late IF deck being as it looks like the filter trimmer access holes on the side were punched at time of manufacture and the markings by them are silk screened. There are some brown tubulars under the IF deck, bypass caps mostly, but not a black one to be seen.

Mygawd, I hope I don't have to replace every one of those brown tubular jobs...that would be a hell of a job. I figured if the filter killer C553 and the 8uF 'rotter' on the audio board were replaced, that got the immediate 'wolf off the door'.

Although come to think of it there are 2 other caps in the audio/limiter circuit Chuck Rippel recommends shotgunning, aren't there?

And I DO have a couple virgin octal plugs to build new filter caps on, although the old ones aren't leaking and there's no hum to speak of...

Has anyone put together a comprehensive list of all the caps in the radio that should be replaced if one is going to go over-the-top? If it's every non-silver-mica/non-ceramic-disc in the radio, frankly, I dread getting into it to THAT extent...but if that's what has to be done...at that point it ain't fun anymore...

Date: Sat, 11 Sep 2010 18:16:29 EDT
From: Flowertime01@wmconnect.com
Subject: Re: [R-390] The saga cont pt 6 pleasant surprise

OOPS, You gotta know one when you see one.

There are some brown tubulars under the IF deck, bypass caps mostly, but not a black one to be seen.

All the late model ones were brown. In the day they were the latest and greatest in plastic technology. The case has just withstood the test of time and they let moisture in. Next project will be to replace them.

Some 300 Volt items will work well. Move up one decimal point .01 to .1 and such. You just get some more by pass. Cost is not the issue any more. Size is not the issue any more. Exact part number is not an issue any more. You need a good cap that filter out more than it lets in or does not filter out.

Feel free to re land the ground point. There will be a lot more space under the IF deck when your done. If you ever get the RF deck out again replace the brown ones in it also. As long as you have to do the work, exercise the hard ware to get a clean bond between the chassis and the lug.

Date: Sat, 11 Sep 2010 17:26:07 -0500
From: "Les Locklear" <leslocklear@cableone.net>
Subject: Re: [R-390] The saga cont pt 6 pleasant surprise

Brown, Black or Gray, what Bob said! <snip>

Date: Sun, 12 Sep 2010 08:21:23 -0400
From: "Shoppa, Tim" <tshoppa@wmata.com>
Subject: Re: [R-390] Bypass capacitors, R390 and SP-600 [WAS: saga continues...]

I have to really doubt anything like a 99-point-something percent cap failure rate as applied to usability of the radio. That number was probably based on some original manufacturing spec for capacitor leakage. And I don't really doubt that it's true, as measured by hooking the cap to its rated voltage and looking for leakage above a fractional microamp or whatever its original spec was. I have no doubt that old paper caps have way more leakage than new ones. And that this can be important in high impedance circuits. Grid coupling circuits, absolutely, replace that sucker! But in a filament or cathode bypass, who cares that leakage at 300V rated voltage is in the microamps and above the original cap spec? Half the paper caps are being used at 6.3VAC or 3-7VDC, and they could be leaking milliamps without affecting the circuit.

The attitudes of some towards recapping, make me wonder if they are maintaining a radio, or a box of caps. I mean, if you like looking at all those nice orange drops or shiny ceramic discs, knock yourself out. (Personally I like the big light blue colored Murata HV ceramic discs). But I'd rather be using the radio. Replace the ones that'll make it work or work better.

Date: Sun, 12 Sep 2010 07:43:21 -0500
From: <ka9egw@britewerkz.com>
Subject: Re: [R-390] The saga cont pt 6 pleasant surprise

Hey, waitaminnit...parts of my home still have knob-and-tube...I look forward to redoing that with almost as much enthusiasm as I look forward to recapping my IF deck. Fortunately, excepting C553 [currently an AVX yellow unit and quite compact in its dimensions], it looks like all the BBOD's are on mounts out towards the edges of the deck where they can be gotten at...if all these BBOD's were buried atop the tube sockets I'd likely put the radio on the auction place
and wash my hands of it...but everything so buried seems to be silver mica's or ceramic discs, both of which I'm perfectly willing to leave alone...<snip>

Date: Sun, 12 Sep 2010 09:33:48 -0400
From: rbethman <rbethman@comcast.net>
Subject: Re: [R-390] The saga cont pt 6 pleasant surprise

<snip> GET RID OF THE BROWN TUBULAR CAPS!!!! They are BAD NEWS, and leak like hell! Put in a polyester cap of some "breed", in lieu of them!

Date: Sun, 12 Sep 2010 08:59:46 -0500
From: <ka9egw@britewerkz.com>
Subject: Re: [R-390] The saga cont pt 6 pleasant surprise
To: "rbethman" <rbethman@comcast.net>, <r-390@mailman.qth.net>

I'm open to anyhone's input about various series of caps to replace the BBOD's...600V Orange Drops seem to be the popular choice, but is there anything that fits in the available space more readily? Is 600V really necessary in the case of, say, a cathode bypass? Any reason not to use ceramic discs for 455kc bypasses? [I know Chuck Rippel has advised against using disc ceramics in AF circuits...]

Date: Sun, 12 Sep 2010 11:01:33 -0400
From: k2cby <k2cby@optonline.net>
Subject: [R-390] The saga cont pt 6 pleasant surprise

I used the Vishay version of Orange Drops from Mouser to recap my R-390A, and I regret doing so. I have since re-capped an SP-600 using ceramic capacitors - the same sort Hammarlund used in the later versions of the SP-600. They are much easier to fit into tight spots, take up much less space, will generally require shorter lead lengths, I believe they will last just as long as Orange Drops provided you buy quality parts. I wish I had used disc ceramics to do my R-390A!

Date: Sun, 12 Sep 2010 10:09:22 -0700
From: "Craig C Heaton" <wd8kdg@att.net>
Subject: Re: [R-390] The saga cont pt 6 pleasant surprise

Have to ask; were the results of using Orange Drops that poor?

Date: Sun, 12 Sep 2010 13:17:45 -0400
From: wa4aos@aol.com
Subject: [R-390] If those capacitors could talk

I have repaired/restored more R 390A and R 390 receivers than I care to remember. From my experience I can honestly say most of those caps would say, "Leave me alone, I'm just fine." While the some of the resistors are screaming, "change my diaper, I can't handle anymore load ! ! !"

In the beginning, I shot-gunned all of the 18 standard bypass caps in the IF modules as well as 4 on the RF deck and the others on the audio module. Most of the canned Electrolytic caps, C603 and C606, on the Audio modules have been physically and Electrically leaky. That is to say, you will often see white crud coming from the base and when tested for leakage at voltage, they test leaky. I see this so often that I buy batches of these from Sigma Technologies in Germany. He advertises on ebay and makes a great replacement capacitor set. I have used the ones from Hayseed electronics as well and they are also good. I test capacitors for value with a digital tester and for load/leakage with a Sprague TO6 tester which test the capacitor at or near it's operational voltage.

Here is what is interesting, out of the yellow or aluminum bypass foil caps I have tested, I have found far less than 1% to be the least bit leaky. all most all of these test and work excellent. And actually, 85% or more of the black beauties also test fine. I know it can be argued that these capacitors are in some cases are near 50 years old or older; that is a good argument. However, I so often hear and see people looking for NOS, New Old Stock orange drops. God only knows how old those might be or how many years they sat year round in a hot and cold warehouse. I buy only NEW Orange Drops from Mouser and I believe they are all made by Vishay now.

I actually find far more resistors out of spec than capacitors. I have yet to work on an IF or RF module that did not have 3 or more resistors seriously out of spec. I believe more detail is paid to the capacitors, in part, due to the fact changing out some of the resistors is more involved. I guess ignoring them makes the problem go away??????? Now for something funny.. Audio guys ABSOLUTELY LOVE Black Beauties and think they sound wonderful. While RF guys think Black Beauties are as bad as having wired turds in their radio. Somewhere in between is the truth.

On average, I spend 18 to 22 hours of bench time on an IF module, sometimes more. And, I just love to see IF modules come in where someone cut old capacitors out and twisted new ones to the old leads and added a cold solder joint on top, Please, have a little respect for these receivers.

I use lots of solder wick, a solder sucker, dental tools and various wire cutters. Good lighting, magnifier, steady work bench and a comfortable stool/seat for your big butt is just as important. One tool that I have found to be very helpful are the miniature flush cutters with the flat cutting side. These are/were often used to cut leads off close or flush to the back of a PCB. Jameco Part no. 35482 is an example..

Once most of the solder is removed from a lead, these flush cutters help with getting on the lead and peeling it away from it's connection post. In

many cases, you can grap the lead, pull it and start twisting the lead CCW or CW depending and it unwinds almost like tuna tins once did by using the provided key. As far as dental tools, try to find good quality stainless pieces, not the cheap off shore junk that seems to have permeated the market. There are 5 or 6 places under the IF module where capacitors are soldered to small phenolic post. These will easily crack with even gentle care. I use those cheap Radio Shack solder heat sinks; the ones that look like a flat clothes pin and try to not heat the post very much. Otherwise. it will break and you will have to glue it back or find a replacement. I found a source on ebay recently for some nice Russian made pieces that are very close. The two standoffs near the front of the module will crack on the phenolic. The 4 others on the circuit board will easily crack into; take your time and EASY DOES IT. If you are not a patient person this may not be a job for you.

If I have to go deep to remove a out of tolerance resistor, I generally remove and replace all of the bypass caps in this area. If I don't then I replace the black beauties usually found on the older Motorola, Amelco and Collins sets. I have decided to stop replacing capacitors for the sake of doing so unless a customer request that service. I use to use my digital camera and take pics to help remember where all the parts go but having done it so often, I no longer need to, although, I do provide customers with pictures of my work.

Most of the performance gains I have observed on IF decks have been with replacing resistors and tubes as well as cleaning all connectors with DeOxit. With the exception of C603 and C606 as well as the caps recommended by Chuck Ripple to improve audio, I think lots of time is wasted on IF recap jobs. One note about resistors, just because they have not been soldered in before don't ASSUME they are in spec. About 10% of the GOLD band resistors I check are more than 15% out of spec. I have a source in my area that allows me to bring in an Ohm meter and cherry pick the one I want. I would think any dealer trying to sell parts would not mind.

BTW: Not to go on and on but recently, I was in the market for a replacement electric screwdriver after by Black and Decker unit failed again for the third time in a year. I read all sorts of reviews and went to the big box stores. When I got to Home Dpeot, the guy showed me a wonderful tool made by Ryobi for $39.00. It has the Lithium-Ion batteries and bright work LED. Additionally it has a locking chuck that keeps the hex head tools from falling. What I really like is the fact it has variable torque just like the big electric screw drivers. It is not variable speed but by adjusting the torque to 5 and driving screws into the front panel of a 390 or (A) it simply spins once you get to the end of travel. No stripping the head or worse, scratching the panel. I liked it so much, I went back

and bought one for the other two workbenches. Here is a link:
http://www.ryobitools.com/catalog/power_tools/drills_drivers/HP41LK ;

Date: Sun, 12 Sep 2010 13:46:28 -0400
From: rbethman <rbethman@comcast.net>
Subject: Re: [R-390] If those Capacitors could talk

My point of those BBODs and Brown versions, is that I have been restoring some St. J's survivors. They are ALL "Bad News Beaars!", get RID OF THEM. Look for ANY brown postage caps. These TOO are plastic covered paper caps!

So far, I haven't found issue with the "red" silver mica caps.

Resistors are DEFINITELY "suspect". They are carbon composition types. Aside from age, they have been exposed to heat and moisture!

By ALL means, TEST and REPLACE out of Spec items!

I do NOT go Willy Nilly in replacing components! I've found the plastic coated silver Sprague caps to be fine, along with those yellow Aerovox, (or whatever the brand is), to be perfectly in tolerance and nil leakage!

Those "acid electrolytic" caps on the audio board MUST go!
Check all THOSE resistors TOO! Replace as found out of spec!

Date: Sun, 12 Sep 2010 13:03:03 -0500
From: "Cecil Acuff" <chacuff@cableone.net>
Subject: Re: [R-390] If those Capacitors could talk

I'm using a Sencor cap anaylzer and I can't say I have found any that met the leakage spec at rated voltage. I have a large plastic container I throw them in when replaced. If you go to the trouble to remove one end for testing it's just about as easy to just go ahead and remove the thing and replace it. If you are not removing one end and and testing you will be back.

For the leave it alone camp that says "yes it fails the leakage test at rated voltage but it's only run at 10% of that in the circuit" I respond...the leakage is a symptom of degredation that will only progress until it becomes leaky at it's working voltage. The designers didn't plan for that value of parallel resistance in the bypass circuit. It will eventually affect performance and load the power supply to the point of increased heat dissapation from other components. Replacing them with quality modern caps means you can plan on not having to go back into the radio for a cap failure most likely in your lifetime.

Also yes...resistors should be checked. It's easy enough to do most of the time with the tubes pulled out. Try to put carbon resistors back in their place. The modern metal film resistors do have inductance and can cause problems in some cases.

Also watch out for the old silver micas they fail as well. (silver migration) Not nearly as often as the paper caps but they do fail.

Last, but not least, tighten all hardware. You'd be surprised at the problems that can cause and have you chasing your tail.

Date: Sun, 12 Sep 2010 13:08:42 -0500
From: "Cecil Acuff" <chacuff@cableone.net>
Subject: Re: [R-390] If those Capacitors could talk

Be careful.....While the St. Julians Creek radios are more susceptable to the cap (and resistor) issues it is not limited to only radios from the piles. It happens to all of them... We have a past member that would like you to believe that it only happened to the St. J radios but he is dead wrong and several on the list have the documentation to prove so including myself.

Date: Sun, 12 Sep 2010 14:18:47 -0400
From: rbethman <rbethman@comcast.net>
Subject: Re: [R-390] If those Capacitors could talk

I have NO false illusions! I treated a '67 EAC with the SAME viewpoint! I checked and replaced MANY resistors and caps! Also found the "infamous" acid electrolytic on the Audio Board! Checked and replaced resistors there and throughout the entirety! These ISSUES apply to ALL of these radios!

Date: Sun, 12 Sep 2010 11:24:10 -0700 (PDT)
From: Rasputin Novgorod <priapulus@yahoo.com>
Subject: [R-390] test them in circuit?

> I test capacitors for value with a digital tester

I can test capacitors and resistors that are loose, on the bench. But how do you test them in circuit? Do you un-solder on end?

Date: Sun, 12 Sep 2010 15:53:31 -0400
From: "James A. (Andy) Moorer" <jamminpower@earthlink.net>
Subject: Re: [R-390] Bypass capacitors, R390 and SP-600 [WAS: saga continues...]

Do you have any opinion on the composition of the ceramics? Should they be NPO, or can they be inexpensive Z5U?

Date: Sun, 12 Sep 2010 17:34:46 -0400
From: rbethman <rbethman@comcast.net>
Subject: Re: [R-390] Bypass capacitors, R390 and SP-600 [WAS: saga continues...]

The "inexpensive" Z5U are just fine! I see absolutely NO reason to go to NPO types in EITHER the SP-600 OR the R-390(X) types of equipment! Neither one had that type of component in it to begin with - at least from "MY" experience with a Northern Radio SP-600 and a couple of R-390As.

Date: Sun, 12 Sep 2010 17:39:05 -0400
From: "Shoppa, Tim" <tshoppa@wmata.com>
Subject: Re: [R-390] Bypass capacitors, R390 and SP-600 [WAS: saga continues...]

Z5U is just fine for bypass.

NPO 0.1uF 500V ceramics are available but will cost you close to $5-$10 each.
Z5U will cost just a few percent of that.

Date: Sun, 12 Sep 2010 17:36:33 -0500
From: Robert Nickels <ranickel@comcast.net>
Subject: Re: [R-390] The saga cont pt 6 pleasant surprise

I'm also a big fan of ceramics, especially for bypassing. But based on a quick search the other day, prices seem to have gone up quite a bit for the 1000 volt parts. Anyone have suggestions for a source of good quality and reasonably priced ceramics? I'd be looking for quantities of 100 or so, common values.

Date: Sun, 12 Sep 2010 19:09:44 -0500
From: "Cecil Acuff" <chacuff@cableone.net>
Subject: Re: [R-390] Bypass capacitors, R390 and SP-600 [WAS: saga continues...]

Yes and no.... The paper caps in the SP-600 were the worst/ The R-390A's were better but not tremendously better...based on what I have seen through here. The R-390/URR is a whole different animal. Quality caps throughout. I've never
had to replace but a few over the years. Much more reliable radio in several ways. Manage the heat and they will run forever I would guess.

Date: Mon, 13 Sep 2010 06:54:10 -0400
From: "Shoppa, Tim" <tshoppa@wmata.com>
Subject: Re: [R-390] The saga cont pt 6 pleasant surprise

I like the Murata DEB series in the 1, 2, 3 kV range.
Go to Mouser.com and type "Murata DEB" into the search box.

Date: Mon, 13 Sep 2010 08:27:24 -0500
From: <ka9egw@britewerkz.com>
Subject: [R-390] The saga cont pt 7

I'm staring at this IF deck, trying to figure out how the heck to get all those Orange Drops in there, if that's the route I go...and going into total information overload reading the "Capacitors" thread in Wei Li's "pearls".

Anyone got a pic of a deck with all Orange Drops just to reassure it can be done?

Date: Mon, 13 Sep 2010 09:33:43 -0400
From: Barry <n4buq@knology.net>
Subject: Re: [R-390] The saga cont pt 7

It can be done - I have done it. What voltage ODs are you considering using? I went with 400V. If you're considering 630V, that really might get very tight in some places. The last IF deck I did, I decided to use some good axial-lead caps. Much easier and they should outlast me.

Date: Mon, 13 Sep 2010 09:55:00 -0400
From: Walter Wilson <wewilsonjr@gmail.com>
Subject: Re: [R-390] The saga cont pt 7

I've done it many times. Pictures on my website at www.r-390a.us
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Date: Mon, 13 Sep 2010 06:57:13 -0700
From: "Craig C Heaton" <wd8kdg@att.net>
Subject: Re: [R-390] The saga cont pt 7

Just mention the word "Capacitor" and the Kielbasa juice starts flowing. If you go that route (Orange Drops), pick the voltage rating closest to the one being replaced, maybe on step higher. They will fit. The few R-390A's which crossed my repair bench took about two weeks for the first pass; trying to restore. Gear train on the RF deck takes a while, only a few caps to replace there. Darned IF takes a while, I get tired just looking and replace one section per day. Audio board is a no brainer.

After that peak n' tweak coils, cans, check signal plus noise vs noise, do

the math. Then fix other things that will pop up.

Date: Mon, 13 Sep 2010 15:05:27 -0500
From: Tom Norris <nu4g.radio@gmail.com>
Subject: Re: [R-390] The saga cont pt 7

Why the insistence on Orange Drop type caps when the original layout was built to use axial caps? I've yet to find any problems using axial packaged film capacitors instead, in fact most I've found have cost less and had similar specs re: temp range, ESR etc. (ESR shouldn't matter diddly squat in an R390, etc) Other than those who were used to using Orange Drop caps from when they worked in TV-Radio shops and were simply "more familiar with them and think they are better" or such, why not put in the type of package that was there to begin with rather than wrestling OD's into place? Besides, Sprague doesn't make them any more...

Date: Mon, 13 Sep 2010 16:19:08 -0400
From: "Bruce Hagen" <b_hagen@sbcglobal.net>
Subject: Re: [R-390] The saga cont pt 7

I suppose one reason could be that if you find a piece of consumer goods built way back when with orange drops you will find that most if not all of them are still good.

Date: Mon, 13 Sep 2010 18:28:36 EDT
From: Flowertime01@wmconnect.com
Subject: Re: [R-390] The saga cont pt 6 pleasant surprise

<snip> Recapping an IF deck is not as much effort as imagined. <snip>

Date: Mon, 13 Sep 2010 17:56:39 -0500
From: "Cecil Acuff" <chacuff@cableone.net>
Subject: Re: [R-390] The saga cont pt 7

Many have done just that. It works too... Would prefer good old made in America caps...if there is such a thing anymore. Best all around....Axial lead ceramic disks. Keep em next to my metric crescent wrench...:-)

Date: Mon, 13 Sep 2010 19:45:55 -0700 (PDT)
From: Perry Sandeen <sandeenpa@yahoo.com>
Subject: [R-390] Arising from the dead: Again

>Wrote: Also yes...resistors should be checked. It's easy enough to do most of the time with the >tubes pulled out. Try to put carbon resistors back in their place. The modern metal film >resistors do have inductance and can cause problems in some cases.

<snip> Our great contributor from the past, Dr. Jerry, covered this extensively in previous posts. His tests showed that there was NO measurable inductance until up into the GHz range.

If you try to buy Art?s Original?s from Mouser and others, they are almost unobtainium and very expensive? Why, you ask? Because they are very inferior to both metal film and carbon film resistors. Because of this almost no one buys them. Over the years list members have made numerous posts concerning value shifts they had found in their R390As with carbon comps. Also they change value during operation with the high temperatures in BA receivers. Also remember that the OEMs are 50 plus years old. Just because they look good does not mean they are good. Even if a radio is operational that does not validate the old parts. It simply means that the parts have not become so bad that some circuit will not operate.

Never forget the difference between OPERATIONAL and OPTIMINE. They are worlds apart.

Several years ago I sold to the list members about 30 complete resistor replacement kits for both the R390A and SP 600. 99 percent were metal film. No one has said to me or to the list that they had any problems. Nada, zilch, zero. No list member that I can recall has posted any problem where a metal film replacement caused a problem and had to be replaced by a carbon composition type to operate properly

Wrote: I do NOT see the need to shotgun 390s or 390As, except for the several critical and failure-prone caps -- they do not have the same record of unreliability as SP-600s.

Both Chuck Ripple and Dallas Lankford have published audio circuit improvements for the R390A. In his audio improvement circuit for the SP 600 chuck specifically advises to use metal film resistors for improved performance.

I tend to agree about doing a shotgun approach on some of the R390A modules as it is a real chore. But if you have to go into a module to do caps I believe one should do resistors at the same time.

As for the SP 600, since the underside is relatively open, one should replace all the carbon film resistors as well as moving the power dropping resistors to the top side of the chassis. Especially if one is replacing any BBODs.

If you ever have to take out and repair the RF deck of a SP 600, by the time

you get it removed you will want to put in the best, most reliable. resistors, capacitors, and new wires money can buy. For further proof Read The Fine Manual or ask someone who has none it; it will make you a believer. <snip>

Date: Mon, 13 Sep 2010 19:45:55 -0700 (PDT)
From: Perry Sandeen <sandeenpa@yahoo.com>
Subject: [R-390] Arising from the dead: Again

<snip> Not mentioned in the previous series of posts. Use DISK CERAMICS for RF circuits only and FOIL CAPS AKA ORANGE DROPS of audio only. Beware, THIS NOT what Hammarlund did with most SP 600?s. <snip>

Date: Mon, 13 Sep 2010 22:30:00 -0400
From: Barry <n4buq@knology.net>
Subject: Re: [R-390] The saga cont pt 7

>..... Almost all run-of-the-mill axials are metallized film -- you would be better >off leaving the paper caps in it.....

Can you explain this? What's the disadvantage of metalized film caps in these applications?

Date: Mon, 13 Sep 2010 21:59:10 -0500
From: "Cecil Acuff" <chacuff@cableone.net>
Subject: Re: [R-390] The saga cont pt 7

I think I'll do my next rebuild with ceramic disks. We don't hesitate to put them in everywhere in our SP-600's that the designers used paper caps for bypass... It will be easier to put them in some of those tight spots that one has to stuff an orange drop. They are excellent caps though...

Date: Tue, 14 Sep 2010 21:52:14 -0400
From: wa4aos@aol.com
Subject: [R-390] R 390A Pics

I have recapped many of these IF's in R 390A's and here is what I do. If you click on the link you will see part of a chassis I have done recently. Others may use other capacitors or layouts but this is some of my work. http://dsmlabs.com/Natan390A112009/Natan%2011%2030%202009/62.jpg

By changing the last two numbers from 62 to 63 will see another pic. Other pics of that IF are at 64, 65, 75 and 80. However, there are many other pics in that file, just change the last two numbers from 1 to 95.

There may be some omissions/blank files.

Other files of interest are as follows.

http://www.dsmlabs.com/Natan390A112009/Natan%2011%2020%202009/DSCN5317.JPG

Files 5317 ... 5441

http://www.dsmlabs.com/Natan390A112009/Natan%2001%202010/DSCN5588.JPG

Files 5588 5740

Lots of boring pics but maybe some of it might help. Remember just change the last 2 or 3 letters in the link, depending, and remember there may be some blanks and lots of extras.

Date: Thu, 16 Sep 2010 18:31:54 +0000 (UTC)
From: dsmaples@comcast.net
Subject: Re: [R-390] The saga cont pt 7

For what it's worth I gave up using ODs a long time ago in favor of polypropylene caps from Illinois Capacitor sold by Antique Electronics Supply.? The IC caps are genuine axial-lead caps, install easier (leads are smaller gauge, but fine for the cap weight), and give the same performance.

Date: Thu, 16 Sep 2010 12:05:15 -0700 (PDT)
From: Joe Foley <redmenaced@yahoo.com>
Subject: Re: [R-390] The saga cont pt 6 pleasant surprise

American made capacitors!

A Kyocera Group Co.
1695 Seneca Avenue
Olean, NY 14760
USA

Just down the street!

Date: Mon, 27 Sep 2010 13:45:52 -0700
From: David Wise <David_Wise@Phoenix.com>
Subject: Re: [R-390] saga cont pt 12

Leakage is a frequent failure mode in molded mica caps today. Besides

messing up the DC operating point, it spoils the Q. And most of the ones I've seen, only leaked under voltage. As some of the caps are in the R-390A.

Date: Mon, 27 Sep 2010 17:05:40 -0400
From: rbethman <rbethman@comcast.net>
Subject: Re: [R-390] saga cont pt 12

The brown molded mica, (postage stamp mic), are paper caps inside. Same failure mode of the Black/Brown Beauties and Tiny Chiefs. The Red mica caps are the silver mica construction, and suffer from silver migration, throwing values all over the map. Replace them with a good quality disc ceramic.

Date: Mon, 27 Sep 2010 16:14:23 -0500
From: <ka9egw@britewerkz.com>
Subject: Re: [R-390] saga cont pt 12

How about the little cylindrical radial-leaded ones and the mint-green ones?

Date: Mon, 27 Sep 2010 17:21:23 -0400
From: rbethman <rbethman@comcast.net>
Subject: Re: [R-390] saga cont pt 12

Personally, I'd unsolder one end and test them. Although I haven't had an issue with them to date. There are some "smallish" Sprague silver ones with radial leads. Those have all tested good.

Date: Mon, 27 Sep 2010 17:05:09 -0500
From: <ka9egw@britewerkz.com>
Subject: Re: [R-390] saga cont pt 12

The ones I'm talking about [there's one on the primary side of the 16-32Mc first can] are a little bigger around than a pencil lead. I know it's a cap 'cuz the schematic tells me so, but it looks like a miniature version of a VERY old resistor...

Date: Mon, 27 Sep 2010 15:30:51 -0700
From: David Wise <David_Wise@Phoenix.com>
Subject: Re: [R-390] saga cont pt 12

Those are ceramic, known as "dogbones". They almost never fail.

Date: Mon, 27 Sep 2010 21:22:36 -0700 (PDT)
From: wli <wli98122@yahoo.com>

Subject: Re: [R-390] saga

Dogbone caps are also seen in some R-388's. Agree that they are ceramic and not paper. All of mine are still good after 50+ years of use.

From: bavarianradio@comcast.net
To: "Roy Morgan" <k1lky@earthlink.net>
Sent: Sunday, January 23, 2011 4:20:01 PM
Subject: Re: [R-390] Cam Pins

Hello, Before I completely reassemble my RF deck, What should I know about the Vitamni Q capacitors?? Should I shotgun replace all of them, or do they hold up OK?? They seem a bit more reliable than the BBOD's but I don't want to take this apart more times than necessary. If I replace the Vitamin Q's with orange drops, should I wrap them in copper foil and ground the foil?? Thanks, Ross

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Date: Mon, 24 Jan 2011 13:50:08 +0000 (UTC)
From: bavarianradio@comcast.net
Subject: [R-390] Fwd: Vitamin Q caps

They are extremely reliable and likely are all fine.
I would not,. (shotgun replace all of them)

Almost every BBOD you find is leaky. Almost every Vitamin Q you find will be fine. No, the cases are not intentionally grounded (and are some times
insulated with a clear plastic sleeve). As far as I know, neither lead is connected to the case.

Date: Mon, 24 Jan 2011 11:26:32 -0600
From: Tisha Hayes <tisha.hayes@gmail.com>
Subject: [R-390] Capacitor Replacements Vitamin Q

A good rule to follow is to replace what is proven bad and leave the rest alone, unless you have good reason. Good reasons to replace capacitors;

1) They are paper
2) They are BBOD's
3) They are way out of spec
4) It is the "killer cap" on the mechanical filters

Wholesale replacement may sound like a nifty idea but you can end up with a
radio that is seriously out of alignment if those caps are in the RF/IF deck.

I have tweaked with capacitor values in the audio section to improve frequency response and done a few AGC mods to eliminate the "moment of silence". Sometimes I change cap values in the B+ supply to reduce ripple (Chuck Ripple <g>, <j/k>). To a large extent, there is a similar set of rules for the wholesale
replacement of resistors.

Date: Mon, 24 Jan 2011 17:50:15 +0000 (UTC)
From: bavarianradio@comcast.net
Subject: Re: [R-390] Capacitor Replacements Vitamin Q

I agree on this type of equipment where the Mil spec aspect of components kicks in. Consumer grade radios are another can of worms. I'm planning on checking all of the resistors for out of tolerance ones and replacing where necessary.

Date: Mon, 24 Jan 2011 12:22:27 -0600
From: "Cecil Acuff" <chacuff@cableone.net>
Subject: Re: [R-390] Capacitor Replacements Vitamin Q

My opinion.... The R-390/URR was what we know as "Military Grade". The R-390A is more closely "Consumer grade" as far as their capacitor choices were concerned. I have seen as many problems with the Brown Tubulars as the Black ones. I have several cracked in a radio I'm working on right now. It's not an SJC survivor either..before someone throws that flag...

Approach the suspect accordingly... My usual approach is to do a sample test of caps in places that are not critical. If a high percentage come back leaky at rated voltage then a wholesale replacement of "Paper" caps is in order. I'm only speaking of paper caps not micas or others that are known to be fairly reliable.

Date: Mon, 24 Jan 2011 14:43:30 -0500
From: Barry <n4buq@knology.net>
Subject: Re: [R-390] Capacitor Replacements Vitamin Q

Aren't BBODs paper?

Date: Mon, 24 Jan 2011 13:46:55 -0600
From: Tisha Hayes <tisha.hayes@gmail.com>
Subject: Re: [R-390] Capacitor Replacements Vitamin Q

Even the best capacitors of the day in 1960 were quite a bit different than some of the high rel component choices we have now, unfortunately most capacitors today are not rated for 600 volts.

The "Orange Drop" type capacitor has developed a near legendary status as a replacement into BA gear. There is some justification for this as it is a fine capacitor for some applications.

Some of the downsides of the Orange Drop;
1) it is big, this is not your father's ceramic disk
2) it can be expensive

Newer is not necessarily better. Look at how many computer and radio vendors got bit by the surface mount caps in everything from PC's to a Motorola Spectra. They die a slow death by suicide yet they had really nice looking temperature and MTBF specs from the original manufacturer. I consider the problems with those capacitors to be in the same boat as the "Black Beauties (sometimes brown) tubular caps of the 40's and 50's.

Electrolytic capacitors have their own issues, they begin to age the minute they roll off of the manufacturing line. You can store them in a lead lined vault, you can reform them (sometimes) but eventually the electrolytic (or oils) inside of the capacitor gradually dries out or evaporates. Nowadays finding a octal base multi-section can capacitor that is "new" may be impossible for some values. Some of us end up restuffing the old capacitor cans or making other accommodations to get a 20-30 or 40 uFd capacitor into that space.

Entropy kicks in and even begins to get to the power transformer and chokes. What may be a buzzy or hot transformer today may be an open or a short when eventually that mechanical motion pulls off a lead or wears down the varnish on the windings. Look at the f aux pas with the Collins mechanical filters and their magical foam that turns into a black goo? RF slugs that get stuck in the coil forms or the way overloaded on/off microswitch.

If there was a modern redesign of the R-390A do you think that it would use those unobtanium min-BNC connectors or even the 125 ohm twinax balanced antenna input?

Trying to stay at least somewhat true to the original design is what makes it an R-390 or R-390A. That is not to say that there are not freakish variants out there with 8 ohm audio outputs, some substitution for the PTO or a different filter setup. Someday the last 6DC6 will wear out and end up being replaced with a FET.

The suggestions on not making a wholesale replacement of any component type is based upon the ugly lessons other folks have learned by going down that road.

Date: Mon, 24 Jan 2011 14:55:48 -0500
From: rbethman <rbethman@comcast.net>
Subject: Re: [R-390] Capacitor Replacements Vitamin Q

BBODs, Tiny Chiefs, and similar are INDEED paper caps.
So are the brown postage stamp ones of old.
I haven't had a single Sprague Vitamin Q give me an issue.

Date: Mon, 24 Jan 2011 15:03:29 -0500
From: "Gary" <xfrmrs@roadrunner.com>
Subject: Re: [R-390] Capacitor Replacements Vitamin Q

As far as I am concerned, Orange Drops are nothing more than a paper cap
with a pretty face. The best "old" caps that I have run across are the silver metal and those "green beauty's". Well, best is not the word but have noticed less failure in them compared to the others. My two cents.

Date: Mon, 24 Jan 2011 14:47:39 -0500
From: Barry <n4buq@knology.net>
Subject: Re: [R-390] Capacitor Replacements Vitamin Q

That "Military Grade" thing is good to know. I was fortunate to find a very nice R390 with lots of extras on the local Craigslist this past weekend and it's now resting in my workshop. It needs a bit of attention but not much. Looking forward to seeing it occupy my CY-979A.

Date: Mon, 24 Jan 2011 16:16:37 -0600
From: GDM <lgdm3@charter.net>
Subject: Re: [R-390] Fwd: Vintamin Q caps

Would some one be so kind as to describe a Vitamin Q or point us to a picture of one? I have an R390A that I was going to recap, but I suspect it may have Vitamin Q's. What I see are small grey/silver cylinders with a plastic(?) bead on one lead.

Date: Mon, 24 Jan 2011 17:16:22 -0600
From: "Cecil Acuff" <chacuff@cableone.net>
Subject: Re: [R-390] Fwd: Vintamin Q caps

They are silver metal cylinders with glass seals on each end. They are what is used throughout the R-390/URR. Not many in the R390A.

Date: Mon, 24 Jan 2011 18:08:00 -0600
From: Tisha Hayes <tisha.hayes@gmail.com>
Subject: Re: [R-390] R-390 Digest, Vol 81, Issue 29

The paper capacitors I refer to are those that look like a cardboard tube (miniature toilet paper roll), usually tan or brown in color with paper end caps.

Yes, the BBOD's and a bunch of other capacitors are paper with some form of dielectric (oil or some electrolyte). The BBOD's became notorious because their cases would frequently crack along a seam and the cap would get very leaky, suffer significant changes in value or just short out.

Another bad cap is the 8 uFd C609 tantalum capacitor in the audio deck. It is rated at 30 VdcW and has a tendency to spew out an acidic compound that will eat up neighboring components.

On the IF deck the 0.01 uFd paper capacitor (C553) should be replaced before it fails in a shorted mode and takes out the IF filters one-by-one as you rotate the bandwidth switch.

The audio deck is filled with paper caps, the IF deck has a few.

If you are not working from a good set of manuals that include the modifications try to get a set of the Y3K R-390A. The manual is free (12 chapters) and runs around a 30 megabyte download. (http://www.r-390a.net/Y2K-R3/)

Date: Mon, 24 Jan 2011 16:33:23 -0800
From: Ben Loper <brloper@gmail.com>
Subject: Re: [R-390] Capacitor Replacements Vitamin Q

I usually replace everything, takes a little longer but I don't have to worry about it

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Date: Mon, 24 Jan 2011 19:42:33 -0600
From: "Cecil Acuff" <chacuff@cableone.net>
Subject: Re: [R-390] Capacitor Replacements Vitamin Q

Orange Drops are very much different....there's not any paper in them with the impurities that came along with the paper. They will also be viable much longer than the paper caps that are in the radio now were... Use them for coupling and Ceramic Disks for bypass... Should be good for as long as tubes are available to keep them running.

Date: Mon, 24 Jan 2011 18:16:24 -0800 (PST)
From: wli <wli98122@yahoo.com>
Subject: [R-390] re; Vitamin Q caps

Made by Sprague, my understanding is that Vitamin Q's are *paper* caps employing metallized paper with a propietary polymer (Vitamin Q) as a dielectric. They are supposedly good up to 125 degees C. They are hermetically sealed in metal cylinders with glass ends. I have done some spot checks, and NONE of mine leaked. However, my test sample is small being under 100 units tested.

I use Sprague Orange Drops as my reference data point insofar as leakage is concerned... comparing any other cap to them. The method I use is to place a VTVM in series with a 300VDC supply and the cap in question (eloquently described by Dr Jerry back in 1998 to us) looking for a reading of under 1.0v. Theoretically, a perfect capacitor with infinite resistance would give a VTVM reading of zero.

The BBOD's are also *paper*. With one exception, all of us on the list have seen these fail wholesale either thru body fractures, or significant electrical leakage on testing, so replacing all the BBOD's is highly recommended.

There is a section in Pearls that deal with caps in the R-390A exhaustively.

Date: Mon, 24 Jan 2011 20:50:23 -0500
From: Barry <n4buq@knology.net>
Subject: [R-390] Capacitor Replacements Vitamin Q

On the subject of replacement capacitors, I have a non-R390[A] that I think may have a leaky 4700pF dogbone ceramic(?) screen bypass capacitor. Would a ceramic disc be a suitable replacement or would this generally be replaced with a silver mica, paper cap, or would it really matter?

Date: Mon, 24 Jan 2011 21:25:42 -0600
From: "Cecil Acuff" <chacuff@cableone.net>
Subject: Re: [R-390] Capacitor Replacements Vitamin Q

I would think CD would be fine...

Date: Mon, 24 Jan 2011 23:18:55 -0600 (CST)
From: nryan@mchsi.com
Subject: Re: [R-390] Capacitor Replacements Vitamin Q

On one or two decks I did wholesale paper cap replacement including Vitamin Q's, but quickly realized it's best simply to go after the BBODs and the potential mechanical filter killer cap, C553.

After pulling any VQ and testing it, I've found it good in each instance -- thus my remorse. Orange Drops in lieu of BBODs are my choice despite the challenge of fitting them in.

Date: Tue, 25 Jan 2011 09:25:18 -0500
From: Barry <n4buq@knology.net>
Subject: [R-390] OT: Update on Blaupunkt

<snip> .....the only thing left was a 4700pF dogbone ceramic(?) capacitor tied from the screen to the "low" side of the IF secondary. I lifted one end of that capacitor and put a temporary 4700pF disc ceramic in its place. Voltages are now restored to what they should be and the secondary resonates quite nicely and the culprit turned out to be a dogbone capacitor. The dogbone ceramic would have been my last suspect. It's still hard for me to believe it could have been that leaky. The paper capacitors would have been the ones I would have shotgunned and left the dogbone alone. All that work and the radio would still not have worked properly.

Date: Tue, 25 Jan 2011 08:49:56 -0600
From: "Les Locklear" <leslocklear@cableone.net>
Subject: Re: [R-390] OT: Update on Blaupunkt

I've seen several bad dogbones in 51J series receivers. YMMV

Date: Tue, 25 Jan 2011 09:51:18 -0800 (PST)
From: wli <wli98122@yahoo.com>
Subject: [R-390] re; dogbone caps

WOW, that was good detective work!

I have not seen a dogbone cap failure, Les experience with *many dogbone failures* is news to me. Live and learn I ses'

Date: Tue, 25 Jan 2011 14:16:50 -0500
From: rbethman <rbethman@comcast.net>
Subject: Re: [R-390] OT: Update on Blaupunkt

I've had several go bad in an SX-101 MKIII. It's why my new DVM has capacitance testing, and I still have an old Heath C-3. You never know WHAT might go bad. I'm developing a "habit" of lifting one leg of damn near every component, so I can test them. I bought a whole batch of metal film resistors too!

Date: Tue, 25 Jan 2011 14:22:39 -0500
From: rbethman <rbethman@comcast.net>

Subject: Re: [R-390] re; dogbone caps

The apparent failure mode of the dogbone caps is whether they were coated on the INSIDE. Every single one I've found bad, had NOT been!

Date: Tue, 25 Jan 2011 13:58:06 -0600 (CST)
From: Jim Haynes <jhhaynes@earthlink.net>
Subject: [R-390] Capacitors

Now if you want some Real capacitors, look at the offerings in www.tubesandmore.com (Antique Electronic Supply) for the audiophools. Caps at $37. each! Handmade with paper and beeswax. Maybe the price is so high because the beekeepers have to risk their lives getting the wax away from killer bees. Or does wax from honeybees make for a sweeter sound? You could make a name for yourself among the audiophools by doing some "research" to show that there are differences in audio quality according to the kind of plants the bees are gathering their nectar and pollen from.

Date: Tue, 25 Jan 2011 14:09:17 -0600
From: Barry Williams <ba.williams@charter.net>
Subject: Re: [R-390] Capacitors

I don't think this is for the audio guys, but I could be wrong. The tube prices are jacked up for them since they are willing to pay it, but there is a different market for paper caps and old resistors. I have a few old issues of ARC magazine and there are some interesting articles about restoring am, and am/fm radios below and at museum level. This is where a restorer would want the old paper caps just for looks as the radios are brought up to perfection inside and out. I know what some are restored with new caps and old caps are carefully placed over them to hide the work.

Date: Tue, 25 Jan 2011 14:26:14 -0600
From: "Les Locklear" <leslocklear@cableone.net>
Subject: Re: [R-390] re; dogbone caps

Well, not "Many", between a 51J3 and J4 if I remember correctly, there were five. I was shocked to find one bad.....

Date: Wed, 23 Feb 2011 20:48:17 -0500
From: Curt Nixon <cptcurt@flash.net>
Subject: [R-390] Which Orange Drops?

The saga begins.... I'm looking to order a bunch of caps and stuff to begin the rework on the 390A. All the info I have seen refers to repacement of all the brown paper tubulars with Orange Drops. So..WHICH orange

drops? I have mostly used the 715 series which are polyester and available in 400 or 600V. I also see the 716P which is supposed tobe a "premium" 715. It is Polypropylene and mostly 400V availablity--but nearly twice the price. Seems the audio and guitar guys have hyped the prices up for the right sounding caps. I'm leaning toward the 715 because I've never had any issues with them, but is there some reason to use another series? Too bad there isn't a similar cap in an tubular/axial package.

Date: Wed, 23 Feb 2011 20:43:33 -0600
From: Tisha Hayes <tisha.hayes@gmail.com>
Subject: [R-390] Which Orange Drops?

715's are fine. I ended up with some 716's when I purchased the closeout inventory of an electronics parts company. Other than being physically bigger I could find no meaningful improvement.

If you go with things like 600 volt caps you may find that they are too big to fit into the available space. Pick up some teflon tubing for lead insulation. I promise you that the caps will not fit perfectly into the little, allocated spaces that the older caps had. Think about the maximum possible voltage you may see in an SP-600 (B+ supply running wild, like if you leave the radio in standby mode with the solid state rectifier mod). A 600 volt cap is an overkill.

I may try to run an orange drop to destruction, just to see how far I can push it before failure, I think the Sencore could do it.

Date: Wed, 23 Feb 2011 21:57:59 -0500
From: Barry <n4buq@knology.net>
Subject: Re: [R-390] Which Orange Drops?

I know that ODs are considered the best and I've recapped an R-390A with them; however, I also recapped one with these:

http://www.justradios.com/capacitors.html

The axial leads were certainly a big advantage but, unlike the ODs, you can burn them easily with the soldering iron.

Date: Sat, 26 Mar 2011 11:38:45 -0500
From: Ben Loper <brloper@gmail.com>
Subject: [R-390] Sigma-Tec capacitors

Does anyone have any experience with these replacement capacitors. I know

they make a variety of replacement parts for R-390's

Date: Sat, 26 Mar 2011 10:04:00 -0700
From: Manfred Antar <mantar@pacbell.net>
Subject: Re: [R-390] Sigma-Tec capacitors

I use them in 2 R-390A's. Also use the 3TF7 replacement module and the Voltage trimmed 26Z5W replacements. High quality parts.

Date: Sat, 26 Mar 2011 17:14:22 -0400 (EDT)
From: ToddRoberts2001@aol.com
Subject: Re: [R-390] Sigma-Tec capacitors

Hi, sigmapert is the name of the seller on Ebay who sells replacement R-390A plug-in filter capacitors that go in the audio module, replacement 26Z5W solid-state tube substitutes and a replacement 3TF7 solid-state ballast tube substitute. He is located in Germany. He lists those items for sale from time-to-time on Ebay. I don't think he has a regular Ebay store or sells his items on the Internet?

Date: Sat, 26 Mar 2011 17:23:22 -0400
From: rbethman <rbethman@comcast.net>
Subject: Re: [R-390] Sigma-Tec capacitors

You'll find that Tom, <n0jmy@hayseedhamfest.com> makes the R-390A caps
completely in new cans and bases with modern electrolytics inside. A brother Ham, and the family members are the "company" and "Manufacturer".

Date: Sat, 26 Mar 2011 18:07:10 -0400
From: rbethman <rbethman@comcast.net>
Subject: Re: [R-390] R-390A caps

Additionally, you'll find the info on his web site.
<http://www.hayseedhamfest.com/capkit.htm>
The price is pretty darn good for the two!

Date: Sun, 27 Mar 2011 11:13:20 -0500
From: Tisha Hayes <tisha.hayes@gmail.com>
Subject: Re: [R-390] Sigma-Tec capacitors

I use both the audio deck caps and the solid state ballast tube from Sigma-Tec. They work great. The capacitors look better than factory original. They are not just re-stuffs into old cans. The only thing you will need to do with the ballast is to attach a ground wire from any convenient point on

the chassis to the top of the solid state ballast replacement to provide a ground. I am quite pleased with his products. The price is a little high but it was well worth it to me.

Date: Wed, 30 Mar 2011 10:26:39 -0500
From: Ben Loper <brloper@gmail.com>
Subject: [R-390] Orange Drop vs ceramic disc

I'm working on a radio & now need to buy some capacitors. My understanding is that the old round flat ceramic disc don't age. Any opinions either way on Orange drops vs ceramic disc.

Date: Wed, 30 Mar 2011 11:31:31 -0400
From: Roger Gibboni <roger@rogershighfidelity.com>
Subject: Re: [R-390] Orange Drop vs ceramic disc

I like the orange drops. Age well. Good price. I use them in all of our production audio amplifiers.--Roger

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Date: Wed, 30 Mar 2011 11:37:28 -0400
From: "Shoppa, Tim" <tshoppa@wmata.com>
Subject: Re: [R-390] Orange Drop vs ceramic disc

Orange drops are capable of handling very high pulse currents. This is important in snubbers in power equipment etc. Note that this is what Sprague sells them for. There will be few places in a radio where this characteristic is needed.

Ceramic discs with wire leads are still available and have superior HF characteristics (lower inductance) and will be superior in most all bypass applications. Audio applications, ceramics are not so clearly a win.

Note that many lines of leaded ceramic discs are being phased out in favor of surface mount components. I'm not pronouncing that the leaded parts are disappearing, I'm sure they'll be around for another century, but realize that 90% + of current production needs are surface mount. Surface mount ceramics also have impressively low lead inductances important for many applications today.

Date: Wed, 30 Mar 2011 10:44:27 -0500
From: Ben Loper <brloper@gmail.com>
Subject: Re: [R-390] Orange Drop vs ceramic disc

A local parts store has ceramic disc capacitors and I could get just about any voltage and capacitance I wanted. I don't know the age so I guess I would call them NOS, if they don't age or fail with age it would be easier for

me to get them here. They also have NOS resistors but I've heard they do change value with age.

Date: Wed, 30 Mar 2011 14:47:51 -0400
From: Barry <n4buq@knology.net>
Subject: Re: [R-390] Orange Drop vs ceramic disc

Why are ceramic caps a bad choice for audio frequencies? Just curious...

Date: Wed, 30 Mar 2011 15:27:59 EDT
From: MillerKE6F@aol.com
Subject: Re: [R-390] Orange Drop vs ceramic disc

Has anyone in this august group made any definitive measurements of distortion or other glitches on a typical X7R Ceramic capacitor. I've been told
that in some high gain audio circuits that some poorly made ceramic caps may tend to act as piezo sensors, but I'll have to do some testing to confirm that parameter. As to metallized fim vs foil and film. Other than self healing and lower pulse current capability, I'd be surprised if one could measure the
difference between the two in connection with distortion or power factor.

Date: Wed, 30 Mar 2011 15:37:18 -0400
From: "Shoppa, Tim" <tshoppa@wmata.com>
Subject: Re: [R-390] Orange Drop vs ceramic disc

See e.g. http://www.edn.com/contents/images/6430345.pdf for some real graphs. X7R is clearly superior to Y5V, but not as good as film capacitors for low-distortion audio.

Date: Wed, 30 Mar 2011 18:03:40 EDT
From: MillerKE6F@aol.com
Subject: Re: [R-390] Orange Drop vs ceramic disc

RE: Maxim capacitor paper..... Granted that at the super low distortion levels the effects of ceramic types can be measured, but in a typical communications receiver audio amplifier section where THD products of 5 percent or 10 percent are the norm, I doubt if distortion products down 60 db or more are going to be measurable let alone heard by mere mortals. And the tests were all done on the smaller SMT caps and I'd like to know if physical size makes any difference, especially on the DC voltage applied parameter. Always willing to read a good study.

Date: Wed, 30 Mar 2011 18:20:36 EDT
From: MillerKE6F@aol.com

Subject: Re: [R-390] Orange Drop vs ceramic disc

Good point on the self healing and I believe I did mention that as a significant consideration. But an anecdotal observation dating for over 55 years spent in the communications industry and specifically maintenance related, the number of capacitor failures specifically related to types would suggest that aside from electrolytic types, most of the tubular capacitors I've seen go to the dark side were as follows. Listed from most frequent to less frequent:

Paper Oil caps of the "Plastic cased Bumble Bee" style
Paper oil caps mostly get leaky both physically and mechanically
Vitamin Q
Plastic cased Oil paper caps
small cased mica caps (WWII)
Silver Mica caps (WWII)
Big Oil Paper High Voltage Caps
Most leaded ceramic types
Metal Film mylar
Metal mylar
Epoxy sealed silver mica
Polystyrene (when not exposed to chemicals and solvents)
Polyprop

This list is based on failure or leakage and not as a function of performance such as ESR, Q, D, etc. Nor does it address subliminal or subjective analysis as is often attributed to "Audiophile" preferences, preferences which seem to put much to much emphasis on the alleged superiority of "Bumble Bee" caps and other units in that category that will leak and short without much provocation after many years of noble service.

Date: Thu, 31 Mar 2011 10:29:55 -0400
From: "Shoppa, Tim" <tshoppa@wmata.com>
Subject: Re: [R-390] Orange Drop vs ceramic disc

Please keep in mind that when it comes to ceramic caps, the dielectric materials available vary widely in their characteristics. COG or NPO ceramic caps could well be golden in audio applications but don't have enough uF per package to be used in most situations. X7R ceramic caps are probably good enough for not-hi-fi applications. Indeed lots of low-end consumer tube stuff from the 60's used ceramic audio coupling caps. Y5V caps literally sound like crap in audio coupling circuits. The latest SMD ceramic caps and their MLCC leaded cousins, almost certainly outperform any 50 year old NOS ceramics we have lying about, every which way from Sunday. I look at the high-end microwave SMT ceramic caps (actually the

highest end ones are glass) and they beat the pants off of any leaded component.

Date: Thu, 31 Mar 2011 14:12:16 -0500
From: Ben Loper <brloper@gmail.com>
Subject: Re: [R-390] Orange Drop vs ceramic disc

OK I can use Orange drops throughout or I can use ceramics for bypass and Orange drop for anything coupling a signal to the next stage. This of course excludes any freq determing applications (micas)

Date: Thu, 31 Mar 2011 20:17:13 -0400
From: "Dave Maples" <dsmaples@comcast.net>
Subject: Re: [R-390] Orange Drop vs ceramic disc

Ben: If I may suggest, the ODs are fine caps, but they are radial-lead caps (designed for PC board mounting). If you are going to redo a boatanchor, I generally find that real axial-lead polypropylene caps (Illinois Capacitor or equal) are a whole lot easier to work with. I've done about a half-dozen boatanchors (and one Pilot AM-FM tuner used in a broadcast station) with the Illinois Capacitor axial-lead caps from Antique Electronics Supply, and I've always been very satisfied.

Date: Thu, 31 Mar 2011 20:18:57 -0400
From: Barry <n4buq@knology.net>
Subject: Re: [R-390] Orange Drop vs ceramic disc

I second that. Axial leads where the originals were axial are so much easier to work with.

Date: Fri, 1 Apr 2011 02:29:41 -0500
From: "Bill Hawkins" <bill@iaxs.net>
Subject: Re: [R-390] Orange Drop vs ceramic disc

I've read this thread very carefully, but I'm left with this burning question: If I drop a ceramic disc into orange juice, does it become an orange drop?

Date: Fri, 1 Apr 2011 08:36:56 -0400
From: Barry <n4buq@knology.net>
Subject: Re: [R-390] Orange Drop vs ceramic disc

>.....disasters waiting to happen .....

I wish I had known. I recapped an R390A with these:
http://www.justradios.com/capacitors.html

Date: Fri, 1 Apr 2011 07:54:00 -0500
From: "Cecil Acuff" <chacuff@cableone.net>
Subject: Re: [R-390] Orange Drop vs ceramic disc

I think it's important to also mention...there are two different type of Orange Drop caps. Can't remember the designations without the catalog in front of me but...there are. I think one is metalized film and the other film/foil types....am I off track here? We need to make sure we don't direct folks using the Orange Drop terminology in a blanket fashion. As I remember one is recommended and the other not so much. I'll have to pull the catalog to fill in the blanks if someone else doesn't chime in...

Date: Fri, 01 Apr 2011 09:39:54 -0400
From: rbethman <rbethman@comcast.net>
Subject: Re: [R-390] Orange Drop vs ceramic disc

OKAY, just my $0.02 worth. We are talking about R-390A/URRs that *have* BBODs. My experience has been that the pre '67 EACs have BROWN BODs. Such as the '51 contract Collins Blue-Striper I'm restoring. I've finally located the nasty caps under the RF deck. I had problems identifying them based on color photos, and discoloration of components from heat. Looking at this from a "practical" aspect, I don't care to use Orange Drops per se. They are TOO large and a pain to use. Now that that is tossed out there, the SP-600 I got in trade in 2004 for my '67 EAC, HAS been recapped underneath with ORANGE DROPS!

I have been running it pretty constantly. There have been NO issues. My ears are still *real* good. Why, I have no idea. I'm NOT an Audiophile, BUT I can hear when there is distortion. I only here it on a very strong station that you have to start reducing the RF gain, AND the volume.

I've been using some kind of film caps to recap the Collins. They aren't ODs.
I *think* this is really getting blown out of proportion! I'd have to ask Barry if having used ODs - "Do you notice ANY degradation?"

Date: Fri, 1 Apr 2011 09:47:20 -0400
From: Barry <n4buq@knology.net>
Subject: Re: [R-390] Orange Drop vs ceramic disc

I have used both OD's and the metalized polypropylene film caps below to restore two different R390As: http://www.justradios.com/capacitors.html Neither radio performed exactly like the other but I can't say that had anything to do with the caps used. I think Don's comments about the MPFs are not that they don't work well, but just that they may fail more often.

Date: Fri, 1 Apr 2011 09:58:46 -0500
From: Ben Loper <brloper@gmail.com>
Subject: Re: [R-390] Orange Drop vs ceramic disc

I may try something this weekend. I have an HP audio osscilator and a two trace scope, so maybe just start feeding a signal through a cap and watch on
the scope. I don't remember the top end but I think 20 khz for the audio oscillator. I can listen also but my ears crap out at about 10 khz last time I checked..

Date: Fri, 1 Apr 2011 10:12:17 -0500
From: "Cecil Acuff" <chacuff@cableone.net>
Subject: Re: [R-390] Orange Drop vs ceramic disc

I don't remember anyone stating that using OD's would cause a degradation... quite the contrary relative to ceramic disk use for coupling. My statement was that there are two different qualities of Orange Drops...and just specifying Orange Drops does not differentiate. Either are probably fine relative to the BBOD's but one OD design is superior to the other.

Now this is where I had to get the catalog out to clear it up. There are the 225P and 715P Orange Drops made by Vishay/Sprague. Both appear to be of wound dielectric/foil design. The 225P uses Polyester as a dielectric the 715P uses Polypropylene as it's dielectric. Both appear to use a thin gauge foil as the conductor which is far superior to a metalized deposition type process.

The 715P is the superior of the two Orange Drop designs because it is designed to handle higher AC currents and pulse circuit designs as well as higher RF loads. It is also a little bit more expensive and physically larger for the same capacitance. If you want the ultimate buy the 715P....if you want far better than the BBOD's the 225P's will be fine. I think one of the points made over the last few years is to stay away from the film and metal deposition type of caps due to some issues with quality control.

Check here for more details:
http://www.mouser.com/catalog/catalogUSD/643/918.pdf

Good middle of the road choice...use Ceramic disks for bypass applications and a good wound dielectric/foil capacitor for coupling and they will outlast your Grand kids.... I think my next SP-600 restoration will include Orange Drops for coupling and Ceramic Disks for bypass...up until now it's been all Ceramic Disks. Maybe the audio can be improved a bit by this

choice...or maybe not.Interesting thought though...

Date: Fri, 01 Apr 2011 10:23:35 -0500
From: Jerry K <w5kp@hughes.net>
Subject: Re: [R-390] Orange Drop vs ceramic disc

I realize this happens often on this list, and it's sometimes fun. But you guys are definitely trying to pick fly poop out of the pepper, collect it in a sock, and beat a dead horse with it. After working on military receivers, transmitters, radars, and such since 1960--mostly Navy, I've personally yet to see a single disk ceramic OR orange drop (that was subjected to normal operating voltages) fail. Ever. Not once. It's possible, and it might even happen on super rare occasions somewhere, but the average MTBF on both types must be an astounding number. And with the FCC limiting U.S. broadcast stations to a 10 Khz bandwidth, and hams limited to 6 KHz (LOL!) worrying about a falloff in
response at 20 KHz is a bit beyond reasonable. I personally like disks, mainly because they are cheap as dirt and OD's are increasingly expensive for reasons unknown. And disks have worked perfectly in the R-390A's I've put them in. The main advantage I can see for OD's is you can flip a module over and tell instantly if and where it's been recapped, since they stand out like a neon sign.

Date: Fri, 01 Apr 2011 11:25:24 -0400
From: Curt Nixon <cptcurt@flash.net>
Subject: Re: [R-390] Orange Drop vs ceramic disc

I doubt that the energies specified would ever be a catastrophic event in any blocking application in a receiver. Normal levels were said to be on the order of 10microwatt-seconds with extremes being 100microwatt-seconds. That level surely is not going to be anything more than a blip of noise in a tube circuit..even a coupling or blocking application at 300V into a grid circuit. Not saying it isn't a better choice to use real foil types, but I will not be red tagging any radios that have self-healing caps.

http://www.electrocube.com/support/metalized_caps.asp

Date: Fri, 01 Apr 2011 11:31:57 -0400
From: Curt Nixon <cptcurt@flash.net>
Subject: Re: [R-390] Orange Drop vs ceramic disc

You will be hard pressed to see any distortion that way..especially at the levels we talked about here. Like 10%... You wont expect it to flat top and there won't be any crossover distortion..it can look very sinusoidal and still have quite high
distortion levels.

Date: Fri, 1 Apr 2011 10:44:40 -0500
From: "Cecil Acuff" <chacuff@cableone.net>
Subject: Re: [R-390] Orange Drop vs ceramic disc

Agreed...with OD's and Ceramic Disks.

Date: Fri, 01 Apr 2011 12:10:10 -0500
From: Randy and Sherry Guttery <comcents@bellsouth.net>
Subject: Re: [R-390] Orange Drop vs ceramic disc

You're braver than I am - I just don't wish to take chances with a mechanical filter (or RF / IF coil); esp. with a better solution easily at hand.

Date: Fri, 01 Apr 2011 13:17:58 -0400
From: rbethman <rbethman@comcast.net>
Subject: Re: [R-390] Orange Drop vs ceramic disc

This is *precisely* why you use the ratings that have been posted in-ad-nauseum! PLUS do the surge suppressor route! Does ANYONE *really* think that they can do a BULLET-PROOF restoration? <snip>

Date: Fri, 01 Apr 2011 12:38:30 -0500
From: Randy and Sherry Guttery <comcents@bellsouth.net>
Subject: Re: [R-390] Orange Drop vs ceramic disc

Yup. I've restored several hundred vintage radios, hi fis, musical instrument amps, test equipment, etc. in the last 35 years... I HAVE had brand new, current production capacitors fail; and so on. <snip>

Back to caps... I bought some caps from a well-known supplier - yellow axials... one of them shorted within a month - took out a screen resistor, but nothing else (fortunately) that's the ONLY return item I've ever had... Learned my lesson. Buy good stuff.

Date: Fri, 01 Apr 2011 14:09:56 -0400
From: Curt Nixon <cptcurt@flash.net>
Subject: Re: [R-390] Orange Drop vs ceramic disc
To: Randy and Sherry Guttery <comcents@bellsouth.net>

Yes...absolutely..that is a "special situation" I have replaced that particular cap with a foil based QD rated at 600V.

Date: Fri, 1 Apr 2011 13:51:00 -0500
From: Tisha Hayes <tisha.hayes@gmail.com>

Subject: [R-390] Death by Oranges

>I realize this happens often on this list, and it's sometimes fun. But you guys >are definitely trying to pick fly poop out of the pepper, collect it in a sock, and >beat a dead horse with it.

Amen to that.

Date: Fri, 1 Apr 2011 16:03:46 -0400
From: "Bernie Doran" <qedconsultants@embarqmail.com>
Subject: Re: [R-390] Orange Drop vs ceramic disc

Where did you come up with hams limited to 6KC?
The only time I have heard that is from SSB ops.

Date: Fri, 1 Apr 2011 18:03:06 -0500
From: Ben Loper <brloper@gmail.com>
Subject: Re: [R-390] Orange Drop vs ceramic disc

I started looking over the inside of my 75A-2 and I have at least 5 different kinds of caps. I'm leaving the micas alone. I already noted several black beauties. I'm thinking that any caps tied to ground I'll replace with a disc and maybe use a OD for anything that is a coupling capacitor. I don't have a lot to replace so I have time to look at it in the circuit and decide.

Date: Fri, 01 Apr 2011 20:46:22 -0500
From: Gary Pewitt <garypewitt@centurytel.net>
Subject: Re: [R-390] Orange Drop vs ceramic disc

Barry, thanks for posting the link and thanks to Arne for building a very fine useful web page.

Date: Fri, 1 Apr 2011 22:56:16 -0400
From: Barry <n4buq@knology.net>
Subject: [R-390] On the subject of replacement capacitors...

I'm working on a General Radio 1617A capacitance bridge. (At least) one of the electrolytics in the detector board is no longer acting like a capacitor. This particular one is 5uF and is a coupling capacitor (120Hz signal). Because they're not "standard" anymore, the 5uF caps are about 4 or 5 times the price of a 4.7uF. Should I worry about the capacitance difference for this application? I know the caps are generally -10%/+50% (or something like that) so the originals may or may not have been all that close to 5uF to start with. I ask because this is test equipment (very nice equipment at that) and I want it working as correctly as possible; however, I'm still pretty sure this won't make any difference but wanted to

"ask the experts".

Date: Sat, 2 Apr 2011 11:25:53 +0200
From: "Paul Galpin" <galpinp@absamail.co.za>
Subject: [R-390] Capacitors - Testing and identification.

Two questions, relevant to R390s and other sets

1. When I replace a capacitor, I test it by putting it across my 500V Insulation tester. Only if it comes down to infinity do I then put it into the receiver. What is the general opinion of this? Is it adequate (for safety, of course, not capacitance value)

2. Everybody in the States seems to know what are Orange drops, BBODs, metallised foil, etc, etc. Over here in RSA, we don't seem to have those ranges and certainly not down here in Port Elizabeth. But we do have second hand capacitors. Where could one get pics of these things to help ID the different sorts?

Date: Sat, 02 Apr 2011 05:21:44 -0500
From: Jeff Adams <physicist@cox.net>
Subject: Re: [R-390] Capacitors - Testing and identification.

Paul, try Digikey. http://search.digikey.com/

Date: Sat, 2 Apr 2011 09:09:10 -0500
From: Tisha Hayes <tisha.hayes@gmail.com>
Subject: [R-390] On the subject of replacement capacitors...

If you are replacing one of the caps on a capacitor bridge it needs to be "right on" the same value. Preferably one with very tight tolerances. Since there are usually a few capacitors in the bridge configuration you may even want to consider changing all of them at the same time to new capacitors with the same rating. Ideally caps that were made in the same batch. Bridges are very finicky regarding the value of components. That is not an area where "near enough" is "good enough".

Date: Sat, 2 Apr 2011 10:38:05 -0400
From: Barry <n4buq@knology.net>
Subject: Re: [R-390] On the subject of replacement capacitors...

This capacitor is part of a "detector" that feeds the meter. There are some precision capacitors with very specific values in the detector, but most of the rest of them are plain-Jane components. Components directly in the bridge circuit itself need to be accurate, yes, but I'm thinking this board doesn't require all of them to be precise. While I'm trying to isolate the bad

parts and see if I can get it working again (just for the mental exercises), I plan to replace all those little electrolytics. That's why I was asking about using a more common, less expensive part. One wouldn't matter, but half a dozen adds up.

Date: Sat, 2 Apr 2011 10:40:13 -0400
From: Barry <n4buq@knology.net>
Subject: Re: [R-390] Capacitors - Testing and identification.

Vaguely on this subject, I'm wondering what folks recommend for small electrolytics. Is Nichicon a trusted brand now? I've used them a few times but don't know much about them. Is Vishay better (as far as reliability)? Others?

Date: Sat, 02 Apr 2011 11:07:17 -0400
From: rbethman <rbethman@comcast.net>
Subject: Re: [R-390] Capacitors - Testing and identification.

Nichicon appear to be fine. I've tested the voltage ratings, I've also tested the capacitance. Vishay is probably a more expensive. The *ONLY* nasty ones that have turned up over the last 5 -7 years were ones made IN CHINA that were put in computer power supplies! Those failed horribly! First signs were bulging tops. My experience, NO proof other than I haven't heard that the '67 EAC that
I re-capped hasn't crapped out in 10 - 12 years. The film caps that I have been re-capping with are ALSO Nichicon. They are *EXTREMELY* close when measured with digital capacitance tester.

Date: Sat, 2 Apr 2011 11:11:30 -0700 (PDT)
From: "Drew P." <drewrailleur807@yahoo.com>
Subject: Re: [R-390] Capacitors - Testing and identification

>Is Vishay better (as far as reliability)? Others?.....

There was a big problem with electrolytic capacitors a few years back, from Taiwan, at least. This caused failure of many computer motherboards and other products. More can be found here:

http://en.wikipedia.org/wiki/Capacitor_plague

>From the above-referenced page: "In one case, the reason for the manufacture >of faulty electrolytic capacitors was industrial espionage gone wrong: several >Taiwanese electrolyte manufacturers began using a stolen formula that was >incomplete, and lacked ingredients needed to produce a stable capacitor.[7]"

As far as present electrolytics from Taiwan and China are concerned, one

would think that the problem would be corrected by now, but who knows? I have seen exploding Chinese electrolytics in recent low cost fluorescent lights having integrated electronic ballasts, but this could just be a matter of poor application.

I used Xicon (Taiwanese) electrolytics from the referenced time period in my '67 EAC and they have not caused any trouble. Perhaps the aforementioned problem was mainly in applications having high ripple current; the R-390A (choke input filter) is definitely not a high ripple current application.

Date: Sat, 2 Apr 2011 11:52:37 -0700 (PDT)
From: "Drew P." <drewrailleur807@yahoo.com>
Subject: Re: [R-390] Capacitors - Testing and identification.

>When I replace a capacitor, I test it by putting it.....

This would be a good method if your insulation tester covers a sufficiently high range of resistance (they normally do), and if you do not expose the capacitor to voltage beyond its rating. This assumes a DC test; for a capacitor will "conduct" AC! Electrolytics would be expected to show a much higher leakage than other types. I like the method advanced in this forum a while back by Dr. Gerald Johnson; this used a DC power supply and a high impedance DC voltmeter (such as a VTVM or DMM) to indirectly measure leakage current at an appreciable voltage.

>.....Over here in RSA, we don't seem to have those ranges.....

I am surprised that Port Elizabeth, a large industrialized city, does not have electronic parts vendors who would stock the parts you would need. Along with the previously posted Digi-Key you could also try Mouser (mouser.com). Be advised that both of these organizations are in the US; international shipping will not be cheap. Information on capacitor type identification and application can be found at the following page and by following links referenced therein:
http://en.wikipedia.org/wiki/Capacitor More than you would ever want to know about capacitors as used in R-390A can be found under the heading "Capacitors" at: http://r-390a.net/Pearls/index.htm. There you will also find detailed Dr. Gerald's method. <snip>

Date: Sat, 2 Apr 2011 12:15:41 -0700 (PDT)
From: "Drew P." <drewrailleur807@yahoo.com>
Subject: Re: [R-390] On the subject of replacement capacitors...

>.....This capacitor is part of a "detector" .....

Aluminum electrolytic capacitors are low precision devices. The tolerance is specified, in many instances, as -50% +100%. The capacitance value has a large dependence upon applied voltage and temperature. In a bridge null indicator, the application you mentioned, you are looking for just that - a null. It is beneficial to have a good sensitivity in the indicator, but you are, after all, looking for zero, and precision is not important. I don't think that in the application, that 4.7 uF vs 5 uF, a 6% change, would make any appreciable difference. That 6% would be swamped by tolerance and also by capacitance change incurred over temperature and voltage excursions. If this really worries you, you could use tantalum electrolytics, at higher precision and much higher price, if available in the required voltage rating.

Date: Fri, 22 Apr 2011 12:53:59 -0400
From: "rkofler@aol.com" <rkofler@aol.com>
Subject: [R-390] Question

My R-390A is an EAC 1967 contract. Looking at the Y2K manual, chapter 12 page 5, my IF sub-chassis appears to be the MOD 1 with the trimmers on top of the filters. My question is: Looking at the drawing I don't see a C-553 listed. What capacitor am I supposed to change to protect the filters from getting zapped by the B+ ?

Date: Fri, 22 Apr 2011 13:01:21 -0400
From: Barry <n4buq@knology.net>
Subject: Re: [R-390] Question

C553 is not one of the trimmers. It is located underneath the IF chassis. Chuck Rippel used to have a webpage that clearly showed its location but I can't seem to find that at the moment. Perhaps another list member can point you to that page.

Date: Fri, 22 Apr 2011 18:13:20 +0100
From: "Lester Veenstra" <lester@veenstras.com>
Subject: Re: [R-390] Question

r-390.com

Date: Fri, 22 Apr 2011 12:36:49 -0500 (CDT)
From: nryan@mchsi.com
Subject: Re: [R-390] Question

C-553 is located under the IF chassis in the section where the mechanical filters live. It is a .01 mfd tubular paper-in-oil capacitor, nestled between L-505 and one of the bandwidth switch wafers. One leg of this cap is connected to L-505, the other to a lug on said wafer. Use a high quality

replacement capacitor such as a Sprague orange drop, .01 mfd @600 VDC. Before installing it, test the replacement capacitor for leakage, just to make sure.

Date: Fri, 22 Apr 2011 11:09:40 -0700 (PDT)
From: Joe Connor <joeconnor53@yahoo.com>
Subject: Re: [R-390] Question

Here is Chuck's page on the problematic caps (including C-553)
http://classic-web.archive.org/web/20080112212428/www.r390a.com/ProbCaps.html

Here is the web address for Chuck's R-390A page:
http://classic-web.archive.org/web/20080212161221/http://www.r390a.com/

Date: Fri, 22 Apr 2011 17:40:48 -0400
From: "rkofler@aol.com" <rkofler@aol.com>
Subject: Re: [R-390] Question

Thank you for all the responses. What I meant was, in the Y2K Manual, there seems to be two models of IF sub-chassis, the older unmodified model, and the newer MOD 1 sub-chassis. In the drawing of the older chassis, C-553 is plainly visible. On the drawing of the newer MOD 1 chassis, C-553 is not listed. The reason I mentioned the trimmers on top of the filters is that the manual mentions that as a way to tell which model of chassis it is. If the filters have trimmers on top, it is the newer MOD 1 chassis. Maybe I'm reading the manual

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Date: Fri, 22 Apr 2011 16:45:00 -0500
From: <ka9egw@britewerkz.com>
Subject: Re: [R-390] Question

I have Chuck's entire site archive bookmarked, but it leads me to wonder--whast happened to Chuck? Did he just discxontinue his website, or did something happen to him?

Date: Fri, 22 Apr 2011 17:52:04 -0400
From: rbethman <rbethman@comcast.net>
Subject: Re: [R-390] Question

Then I would have to say that there is definitely some bad info *someplace*! There is only one "model" of the IF subchassis for the R-390A. Either it is the early version, which has NO trimmers for the filters, then the later one WITH trimmers for the filters. I have an EARLY one, NO trimmers, BUT it is stamped MOD 1. C-553 is STILL there - and in

the SAME place! It IS a paper cap in
"most" IF Chassis'. I have found a Sprague Vitamin Q in others. In ANY event - REPLACE IT as stated on Chuck Rippel's page! If it isn't replaced, a surge CAN take out whichever filter is in-line!

Date: Fri, 22 Apr 2011 18:37:44 -0400
From: "rkofler@aol.com" <rkofler@aol.com>
Subject: Re: [R-390] Question

Thank you Bob. That is clear enough. Sometime, take a look at the Y2K Manual chapter 12 page 5. I'm sure its not bad info. I'm probably just reading it wrong.

Date: Fri, 22 Apr 2011 18:25:21 -0500 (CDT)
From: nryan@mchsi.com
Subject: Re: [R-390] Question

It looks like there is a misprint on Figures 12-04 and 12-05
C-553 is shown as C-533.

In these two illustrations the cap is shown lying horizontally. In Figure 12-06 it is correctly labelled and lies vertically. Notice that in all instances C-553 is connected to L-505. It matters not in which position C-553 lies -- it's simply a matter of getting the replacement cap to fit in nicely. It's very crowded in there! Use spaghetti on the leads as Chuck Rippel suggests.

Date: Fri, 22 Apr 2011 19:30:48 -0400
From: rbethman <rbethman@comcast.net>
Subject: Re: [R-390] Question

That is the Y2K-R3. That DOES appear to have an error! What is pointed at and called out *AS* C-533 I believe is actually C-553. It indeed has one end tied to L-505, and while NOT apparent, is most likely tied to the switch wafer. So I added the "CREW" that is working on the latest version of the Y2K to be/is being collected and "built".

Date: Fri, 22 Apr 2011 18:49:21 -0500
From: Tisha Hayes <tisha.hayes@gmail.com>
Subject: Re: [R-390] Question

I will work on getting that corrected in Y3K- R4 and to detail a bit more out on the capacitor replacement.

If anyone else finds things that are unclear or need further elaboration please feel free to contact me directly or through the list.

Date: Fri, 22 Apr 2011 19:03:09 -0500
From: "Les Locklear" <leslocklear@cableone.net>
Subject: Re: [R-390] Question

This was originally improperly identified way back in March, 1984 in HSN Issue No. 1 as C-533. But, it originally came from TM 11-5820-358-35, pages 68 - 69.

I was corrected in the follow-up HSN Issue No. 2 and properly identified as C-553. I guess it just slipped through the cracks over the years even after being the subject of great debate on this list as well as many others.

Date: Fri, 22 Apr 2011 20:03:36 -0400
From: rbethman <rbethman@comcast.net>
Subject: Re: [R-390] Question

The Y2K-R2 has color pictures in chapter 6. Corrective Maintenance.
It is correctly called out there.
C-533 is actually in another compartment of the IF Subchassis.
It is along the outer wall of the module, adjacent to the BFO.

Date: Fri, 22 Apr 2011 20:19:13 -0400
From: rbethman <rbethman@comcast.net>
Subject: Re: [R-390] Question ADDENDUM

The color pictures are courtesy of Hank Arney.**********

Date: Sat, 21 May 2011 20:01:54 -0400
From: k2cby <k2cby@optonline.net>
Subject: [R-390] O.T. Miniature Electrolytic

I recently ran across a miniature electrolytic capacitor shaped like a bullet.
The capacitance and voltage rating were marked, but the polarity isn't.
Am I correct in understanding that the pointed end is plus?

Date: Sat, 21 May 2011 20:54:58 -0400
From: rbethman <rbethman@comcast.net>
Subject: Re: [R-390] O.T. Miniature Electrolytic

If you mean bullet shaped, as it "resembles" the notorious audio module leaking capacitor, I wouldn't use it.

Those are very old style capacitors that have an electrolyte that either turns acid like, or already has an acid component to it. That is why

they are replaced.

Those are the only ones I've seen that have that shape. Then again, I may have missed a design type.

Date: Sat, 21 May 2011 21:14:23 -0400
From: "Shoppa, Tim" <tshoppa@wmata.com>
Subject: Re: [R-390] O.T. Miniature Electrolytic

Yes, pointy end is plus. Modern axial solid tantalums still use this style. Any electrolytic (or "wet tantalum") in a metal bullet case... may very well be several decades old now.

Date: Sat, 03 Sep 2011 02:59:21 -0400
From: Bob - K2KI <k2ki@comcast.net>
Subject: [R-390] Is anyone selling R-390A Cap kits?

I have an R-390A that is in desperate need of a cap overhaul. I sent a message to Walter Wilson from the R390A.us site and his reply was that he was out of stock and by the sound of it, might be for a while. Is anyone providing these kits? Or should I just go ahead and order the caps separately? I trust Orange drops are OK or should I use something else? Any help here would be greatly appreciated.

Date: Sat, 3 Sep 2011 09:08:48 -0500
From: "Cecil Acuff" <chacuff@cableone.net>
Subject: Re: [R-390] Is anyone selling R-390A Cap kits?

Well now you gone and done it...

I agree with your statement about mil qualified paper caps if you are talking about the R-390/URR. Not so with the cost reduced R-390A. The caps obviously were approved by the military for use in the R-390A as offered in the cost reduced receiver. The caps are not any better than those offered in the SP-600 or any of my Hallicrafters receivers with the Red Chiefs. Failure rates are pretty much the same...

I'll be happy to ship you a box of them if you like...all fail the leakage testing on the Sencore cap analyzer which means they have developed a resistive component. One that can be present at any voltage that cap may be subjected to in it's normal use. Once that process starts within the cap it only progresses.

It doesn't matter if the receiver was in a rack for it's life or sat in the pile at St. Julians creek. The outdoor exposure may have tended to accelerate the process but a process it is.

My suggestion is to lift one end of a sampling of the caps and test them with an appropriate tester and replace those that fail. Replace the cap that protects the mechanical filters regardless and use a higher voltage rating on that on for added insurance.

In the event that you don't have an appropriate cap tester and don't plan to do several other receivers as part of your hobby endevours, then replace all the caps and be done with it. Do the work slowly...replace a few and test the receiver...do a few more and test the receiver. This process will help you identify a problem you may introduce in the process of changing the caps. If you are an experienced tech you may be able to just do them all in one fell swoop.

Either way you will have bonded with your new receiver for a life time of enjoyment!

Also to answer your original question...Walter Wilson who is a member of this list may still have the cap kits and also the nice stainless hardware kits to replace

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Date: Sat, 03 Sep 2011 09:36:55 -0500
From: Barry Williams <ba.williams@charter.net>
Subject: Re: [R-390] Is anyone selling R-390A Cap kits?

I guess "Dave in Birmingham" isn't on the list anymore, or he would explain his packs of caps that he used to put together from bulk orders. He was a Hillary lover and we beat up on him a lot for that. Can you hear me, Dave???

Date: Sat, 03 Sep 2011 10:52:13 -0400
From: rbethman <rbethman@comcast.net>
Subject: Re: [R-390] Is anyone selling R-390A Cap kits?

I believe it was Dave Bingham by name.
I had obtained two kits from him. That goes back to about 2000 to 2001.

Date: Sat, 03 Sep 2011 11:20:14 -0400
From: rbethman <rbethman@comcast.net>
Subject: Re: [R-390] Is anyone selling R-390A Cap kits?

Doing a LONG search in archives, His name is Dave Holder, located in Birmingham, AL. That was from a message in 2002. I do not have his call sign.

Date: Sat, 3 Sep 2011 10:30:03 -0500

From: Don Reaves <donreaves@gmail.com>
Subject: Re: [R-390] Is anyone selling R-390A Cap kits?

At a minimum these are the caps I replace before even powering up a long dormant R-390A.

C-553 in the IF deck. Originally .01 at 300V, it blocks DC to the mechanical filters. You don't want this cap to leak and wipe out your filters. This is where I use a 600V Orange Drop because there is room to neatly install the larger cap.

C-609 in the Audio deck. This is an 8 ufd 30V on a bad acid trip. As it rots it will damage the circuit board underneath it. I use a common 10 ufd at 35V axial for a replacement.

C-606 and C603 in the Audio deck. These are the two plugin power supply electrolytic filter caps. I have rebuilt these caps and used third party replacements. hayseedhamfest.com is one source of replacements. There are probably others but I haven't compiled a list lately since I have one Chuck Ripple rebuild kit left in the arsenal. I no longer try to reform 50 year old electrolytics. Life is too short.

I get these 4 suspects replaced then do normal troubleshooting for any individual components that might need replacement.

Date: Sat, 03 Sep 2011 11:40:47 -0400
From: rbethman <rbethman@comcast.net>
Subject: Re: [R-390] Is anyone selling R-390A Cap kits?

The entire list of the old kit is as follows:

R390A capacitor kit.
> I have put together a ReCap kit for the R390A.
> It consists of:
>
> (13) 0.1 ufd
> C256, C309, C504, C505, C517, C521, C528, C531,
> C536, C538, C543, C547, C548
>
> (7) 0,033 ufd
> C275, C529, C533, C534, C541, C545, C602
>
> (7) 0.01 ufd
> C549, C553, C601, C604, C605, C607, C608
>
> (The above are Orange Drops or equivelent.)

>
> (3) 30 ufd 300 v electrolytic C603A, C603B, C603C
> (2) 47 ufd 300 v electrolytic C606A, C606B
>
> (The above electrolytics have axial leads. You can wire them under the
> chassis and leave the originals in place to retain stock appearance.
>Or you can order capacitors small enough to fit inside the cans of C603 &
>C606. Just remember you will have to deal with the Dreaded Black
>Ukkumpucky to get the guts out of the cans of C603 & C606. If you do not
>specify at time of your order, the under the chassis capacitors will be
shipped.)
>
> Finally, one each of :
>
> 0.047 ufd 100v C227
> 8 ufd 30v tantalum electrolytic C609
> 50 ufd 50 v electrolytic C103
> 0.22 ufd 100 v C101
>
> I cannot find a source for:
> 2 ufd 500v C551 oil filled paper
>
> so, I will include a very high quality poly cap. I have installed one of
> these in one of my R390A's and I can say I cannot hear any difference.
They work great. This is the AGC capacitor.

Date: Sat, 03 Sep 2011 12:55:56 -0400
From: rbethman <rbethman@comcast.net>
Subject: [R-390] R-390A re-cap

<snip> As was pointed out by another list member, THE "silver" colored, metallic cased tantalum capacitor on the Audio Deck circuit board, indeed had an acid based chemical component in its make-up. They DO leak and burn through the board, IF they are left there.

The capacitor that protects the filters from B+, *should* be rated for 1KV, per Chuck Rippel. Others will certainly agree.

Date: Sat, 03 Sep 2011 16:49:55 -0400
From: rbethman <rbethman@comcast.net>
Subject: [R-390] Capacitors to give thought to change

I don't recommend a "complete" replacement of capacitors in the R-390As. However, there are a handful that most likely should be.

C-103 - Part of the line filter.

C-603 and C-606. Either suffer through opening and re-stuffing, or order some ready to plug in. I don't give "endorsements", but will point out that Tom, of Hayseed Hamfest, is doing this at home.

C-553 - The mechanical filter blocking B+ capacitor

and last but not least - C-609, the tantalum on the Audio Deck Board.

That tantalum is bad news. <snip>

Date: Sat, 3 Sep 2011 17:50:40 -0500
From: "Cecil Acuff" <chacuff@cableone.net>
Subject: Re: [R-390] Is anyone selling R-390A Cap kits?

> Note that paper caps had significant leakage resistance when they
> were new -- often in the several hundred kOhm range (i.e., leakage
> currents of as much as hundreds of uA with 500 V across them). If
> the leakage resistance has not decreased significantly from that
> level, they are still in "as-installed" condition with respect to
> leakage. One could argue that it is theoretically better to replace
> them with modern parts that have much less leakage -- but that is not
> necessary. Leakage in the hundreds of uA per cap was normal from the
> day the radios were made, and leakage at that level today does NOT
> indicate the decline or immanent failure of the cap. The vast
> majority have not changed since they were installed, and will not
> change over the next 60+ years.

Well maybe the caps in the R-390A were crap when new...I don't know. We can't go back and test any of them as they were when manufactured so none of us really know for sure. What I do know is that the Vitamin Q caps in the
R-390/URR do not fail the same leakage testing as the caps in the R-390A and
they are even older.

Either school of thought is fine. I believe you will be back in the radio that has not had the old paper caps replaced more often that not...but that's part of the "Charm" of these old rigs anyway...right...:-)

Bottom line is have fun. That's what it's all about.

Date: Sun, 18 Dec 2011 19:47:03 -0600 (CST)
From: nryan@mchsi.com
Subject: [R-390] Ceramic Disc Caps Never Fail...

Ceramic Disc Caps Never Fail... ...What, never? Well, hardly ever!

After doing a painstaking replacement of the usual BBODs, off spec carbon comp resistors, electrolytic caps and a couple of bandwidth filters, etc., on a 1957 vintage R-390A, I burned it in overnight. The next day it was deaf on all bands. Trouble seemed to be in the RF deck, but where to start?

The depot manual provides guidance by advising checking resistances and voltages. I did the former and found pin 6 on V401 (the crystal-oscillator deck) to be way off spec. Normal resistance is 55K, instead it read 1.43K.

Suspicion fell on two ceramic disc caps, C401 and C410 -- both are rated .005uF @ 1000V. After pulling the RF deck and its crystal-oscillator subchassis, I clipped a lead on C401 and the resistance reading on pin 6 of V401 went up to spec.

Access for replacement of C401 was difficult, but in the end successful as the radio came back to life. The shaft controlling the two rotary switch discs had to come out to permit access inside. In a careless lapse of judgement, I slid the C-clip ASIDE the shaft rather than ALONG its axis and, of course, it broke. A replacement was handy but I resolved not to make that mistake again.

I think our beloved rigs are getting to the point where components besides paper caps, carbon comp resistors, electrolytic caps and bandwidth filters are beginning to fail. Ceramic disc caps still are reliable, but perhaps the passing years do not bode well for them either.

Here's hoping the burn-in presently underway goes well.

Date: Mon, 19 Dec 2011 11:52:51 -0600
From: Tisha Hayes <tisha.hayes@gmail.com>
Subject: [R-390] Ceramic Disc Caps Never Fail...

I have seen instances of disk cap failures during mass production where maybe the lead spacing was not ideal and the parts placing machine kind of cracked the dipped part right where the lead goes into the capacitor body. Some work fine while the board is on a test jig but fail after the solvent bath or fail after system burn-in (our burn-in period was 10 days while the device was in full operation). Maybe 1 in 20 telemetry packs would fail after burn-in and get sent over to my department for one of my techs to identify the specific component. Then I would try to look for trends and root causes. The stack of paperwork on my desk would be from our repair department where the techs would report on what components were bad on what types of units.

I did catch some things that were bad... like that the plastic wrapped tantalum capacitors that were part of the D/A converter circuit did not like solvents so those had to be hand soldered after board cleaning.

The universe is moving to entropy where eventually everything will fail, atoms will drift apart and the universe will be a cold, dark place. (only happy thoughts for Christmas season <lol>). I have yet to find any sort of never fail component. Some things may have MTBF's of tens of thousands of hours.

Date: Wed, 4 Jan 2012 16:16:45 -0500
From: "Dave Maples" <dsmaples@comcast.net>
Subject: Re: [R-390] Caps

All: I much agree. Mouser is my default for electronic parts; replaced both Digi-Key and Jameco. In order, I search the following for general-purpose parts:

Mouser
Digikey
Allied
Newark

For tubes and that kind of stuff, I go directly to Antique Electronics Supply.

I'd be very interested in what search order other folks use.

As an aside, I did my R-390A with Orange Drops, and then discovered the Illinois Capacitor axial-lead caps at www.tubesandmore.com. I've recapped
four or five pieces of gear with them and have had great success. That's my
first choice for axial-lead caps to replace the old paper caps; others choose differently, of course.

Date: Thu, 05 Jan 2012 18:01:05 -0600
From: Dave Mayfield W9WRL <wrl@gwltd.com>
Subject: [R-390] Audio Deck mod

I can find the simple audio deck mod by Chuck Ripple. But I understand that there is a better mod. It was in ER #42. I looked in my ER collection and I do not have that one. Does anyone have a copy of this mod that you can send me?

Date: Thu, 05 Jan 2012 19:50:05 -0500

From: rbethman <rbethman@comcast.net>
Subject: Re: [R-390] Audio Deck mod

I know I have it. Just don't know where at the moment. When I subscribed, I also ordered all the back issues as a package.

The best thing for the audio is to pick it off the diode load terminals on the back panel and feed to an amplifier. I've got one of the OLD SS Radio Shack mono/stereo amps. It'll do 30W. I feed that to some 1970 vintage Wood Cabinet speakers that I brought back from across the pond. I can switch from the R-390A, SX-101MkIII, or Northern Radio R-450/FRR-28 version of the
SP-600.

Date: Thu, 5 Jan 2012 18:56:24 -0600
From: "Don Cunningham" <donc@martineer.net>
Subject: Re: [R-390] Audio Deck mod

Ray sells the copies cheap. Get it from him and get it quicker than we can copy and mail it. I bought a pretty complete set from a "downsizing" OM and finished it off with missing from Ray at a reasonable price for a couple of full years.

Date: Thu, 5 Jan 2012 23:11:08 -0800 (PST)
From: Perry Sandeen <sandeenpa@yahoo.com>
Subject: [R-390] Paper Capacitor Replacement II

Wrote: As an aside, I did my R-390A with Orange Drops, and then discovered the Illinois Capacitor axial-lead caps at www.tubesandmore.com. I've recapped four or five pieces of gear with them and have had great success. That's my first choice for axial-lead caps to replace the old paper caps; others choose differently, of course.

While any modern film capacitor will be decades better than the film caps that they replace. It is still the wrong choice. No personal offense to anyone, but this is a case of the blind following the blind.

Here?s why. (IIRC, this has been brought up before on the list.) When our BA?s were designed, good ceramic bypass capacitors had not been developed, so wax paper and foil capacitors were used.

As a result and urban myth of using OD's has developed. OD's and their film equivalents are fine for AUDIO only.

Ceramic bypass capacitors have a much lower ESR at RF for any given capacitance. It is well documented in many amateur and professional

electronic books.

Additionally, they are far less expensive and much smaller.

There are those on the list who vehemently disagree with me. But where is their documented scientific proof? All I remember hearing were opinions. Well opinions are like eyeballs. Everyone has one, two, or three of them.

As further proof, for about the last 40 years or so ceramic bypass capacitors have been used exclusively for RF bypass by commercial equipment manufacturers.

Yes, I'm a bit testy about the subject but that is a reaction to those who just keep re-posting over and over their favorite urban legends while ignoring the facts.

I don't care if these individuals recap their radios with whatever they fancy. That is their choice.

Ceramic are for RF ONLY and film capacitors are for AUDIO ONLY.

Deviation results in much lower than-can-be-obtained performance on any given BA on any given day.

Date: Fri, 6 Jan 2012 03:31:01 -0600 (CST)
From: nryan@mchsi.com
Subject: Re: [R-390] Paper Capacitor Replacement II

Is this what we're talking about?

http://www.vishay.com/capacitors/list/product-42016/
http://www.vishay.com/docs/42016/42016.pdf

Date: Fri, 6 Jan 2012 14:28:54 -0500
From: Barry <n4buq@knology.net>
Subject: Re: [R-390] Paper Capacitor Replacement II

Can someone explain why ceramics are better in RF applications (such as bypass) than film-and-foil (or point me to a source that explains it)?

Date: Fri, 06 Jan 2012 14:37:43 -0500
From: Curt <cptcurt@flash.net>
Subject: Re: [R-390] Paper Capacitor Replacement II

RF bypass caps can typically be much smaller capacitance value so the

round disk with thick mica or other HV dielectric is sufficient and easier to make at HV ratings. They also have much less inductance--important for RF Bypass application. An audio bypass cap would be physically HUGE if it we made like a disk configuration. Likewise for coupling application.

Date: Fri, 06 Jan 2012 13:54:29 -0600
From: Randy and Sherry Guttery <comcents@bellsouth.net>
Subject: Re: [R-390] Paper Capacitor Replacement II

> Can someone explain why ceramics are better in RF .....

I can give you a short-form "reason"... Ceramics are made by plating both sides of a ceramic wafer with conductive material - each of which form the plates of the capacitor. As ceramic is an excellent dielectric - it can remain thin and still have high withstand potential. Being thin – a given capacitance requires much less "surface area" than a thicker dielectric - so the area of the plate is small - having little resistance. The leads attach directly – then the whole thing dipped in a coating to protect from contamination. Simple - low inductance and low resistance, Many poly caps are made by coating both sides of some flexible insulating material (which becomes the dielectric) with conductive material (which become the plates. The flexible material stacked with another insulator layer - then rolled into a "tube" to make it compact. Now being in a coil - (rolled up) it now exhibits considerably more inductance than it would were it left flat. Also - having a large area - the resistance is also greater than a similar value capacitor that uses thinner dielectric (which would have smaller surface area).

So ceramics have less inductive reactance losses at RF than most polys - however - polys tend to have better stability at audio. Recall that ceramics use a thin wafer for a given capacitance - that thin wafer may distort at audio frequencies causing changes in capacitance. Ceramic's tendancy to react electrically to physical distortion is the principle behind ceramic phono cartridges.

This is - of course - "over simplified" - but the basics are pretty sound...

Date: Fri, 6 Jan 2012 15:04:21 -0500
From: Barry <n4buq@knology.net>
Subject: Re: [R-390] Paper Capacitor Replacement II

That's just the level I was looking for. I'm familiar with the construction of both types and knew that the ceramics were physically smaller, but I was unaware that the wound layers of a poly or paper cap introduced significant inductance or resistance - at least enough to be a factor at HF frequencies.

Date: Fri, 6 Jan 2012 21:05:23 +0000
From: <kirklandb@sympatico.ca>
Subject: Re: [R-390] Paper Capacitor Replacement II

Once upon a time I pulled data sheets for ceramic disk and film caps and looked at the impedance V frequency plots. For 0.01 uf, I couldn't see a significant difference. Many manufactures indicate that the film caps are non-inductively wound.

I just tried and couldn't easy find info for ceramic caps carried by digi-key. However here is a link to a panasonic film cap
http://industrial.panasonic.com/www-data/pdf/ABD0000/ABD0000CE23.pdf

pg 12 shows data for 0.01 uf. series resonance is between 10 and 20 MHz.

If someone can find a data sheet for a ceramic cap with these curves one could do an easy comparison. One thing to keep in mind: don't forget the lead inductance. 0.01uf resonates at 15 MHz with 11.3 nH. A 1mm dia wire 2 cm long has an inducatance of 14 nH. (hence 1cm lead length will cause a 0.01 uf cap to resonate at 15 MHz)

Date: Fri, 6 Jan 2012 18:20:41 -0500
From: "KR4HV" <kr4hv@numail.org>
Subject: [R-390] Sencore LC53 meter test cable

Does anyone have the specs (Impedance & Capacitance per ft) for the test cable for the Sencore LC53 meter? I need to make a test cable.

Date: Fri, 6 Jan 2012 18:36:47 -0500
From: "Dave Maples" <dsmaples@comcast.net>
Subject: Re: [R-390] Paper Capacitor Replacement II

All: OK, I am properly humbled. It appears now that the only offerings for the film-and-foil caps are radial-lead designs suitable for PC boards but not for point-to-point wiring. I am presuming that the issue with ceramic caps is that the electric field actually interacts with the physical structure of the ceramic and causes the small changes in capacitance, but I may well have that wrong as well.

Date: Fri, 06 Jan 2012 19:08:28 -0500
From: "David C. Hallam" <dhallam@knology.net>
Subject: Re: [R-390] Paper Capacitor Replacement II

Just Radios http://www.justradios.com/ carries of full line of capacitors,

film, mica, and electrolytic. Their prices are good. I have purchased from the many times.

Date: Sat, 7 Jan 2012 01:07:39 -0500
From: bill kirkland <kirklandb@sympatico.ca>
Subject: Re: [R-390] Paper Capacitor Replacement II

With the ceramics you can get a piezoelectric effect. e.g.
http://www.kemet.com/kemet/web/homepage/kfbk3.nsf/vaFeedbackFAQ/242F5F2E69DCEC7485256EDF004CA495

Date: Sat, 7 Jan 2012 09:59:37 -0500
From: "Dave Maples" <dsmaples@comcast.net>
Subject: Re: [R-390] Paper Capacitor Replacement II

Don: Those devices were designed for the leads to remain basically parallel
to the ends of the devices. Bending them 90 degrees all the way to the case stresses the outer dip and in some cases cracks it. I don't know what such cracks do to the moisture seals. Sure, I can (and did) put a 90 degree bend in the lead away from the case to make them work, but they aren't as well-supported as if they were true axial-lead caps, and they look like what they are: the wrong part for the application. I don't know anyone still making real axial-lead foil-and-film caps. If someone knows a firm making them, point them out. The comments from you and others on ESR for ceramic vs. foil caps were right
on the money, and I appreciate them.

Date: Sat, 7 Jan 2012 11:49:23 -0600
From: <dsatterness@sio.midco.net>
Subject: Re: [R-390] Paper Capacitor Replacement II

Check "Partsconnexion".
They have several sources of axial foil and film caps.
Expensive! Intended market is DIY HiFi.

Date: Sun, 8 Jan 2012 14:11:52 -0500
From: Barry <n4buq@knology.net>
Subject: Re: [R-390] Paper Capacitor Replacement II

With all this talk about capacitors, I thought I'd ask about HV polypropylene caps. What are some of the characteristics to watch out for with this construction? The reason I ask is I have a General Radio C bridge that lost its standard capacitor (0.5uF at 800V). I have some polypropylenes from WIMA that I'm considering using to replace it. Particularly, I have a 0.33, a 0.15, and 0.011 that I planned to put in

parallel and then finish with silver micas to get as close to 0.5uF as possible.

Date: Sun, 08 Jan 2012 15:09:47 -0500
From: "Charles P. Steinmetz" <charles_steinmetz@lavabit.com>
Subject: Re: [R-390] Paper Capacitor Replacement II

For a capacitance bridge, you would really like a polystyrene cap. Polypropylene may be the next-best of the common dielectrics, but still not as good. It would be unwise to add silver micas to make up the value, due to their inferior dissipation factor and dielectric absorption -- better to leave the cap below value and apply a correction factor to your measurements. You will want to know the value of the capacitor you install to better than 1%, so you will need to measure it with a calibrated meter or bridge before you install it in any event.

Date: Sun, 8 Jan 2012 15:26:53 -0500
From: Barry <n4buq@knology.net>
Subject: Re: [R-390] Paper Capacitor Replacement II

My first attempt at replacing this is an array of polystyerene caps; however, since they're only rated at 250V, I had to put them in series (actually 9 caps, 3 sets of three in parallel and then those three in series). In this application, I can't very well use balancing resistors, so putting them in series this way was only a temporary device.

I'm going to put the three polypropylenes on a board and have a local metrology lab tell me what their total capacitance is to as close a tolerance as they can give. From there, I plan to pad the board with caps needed to get to 0.5uF at (hopefully) better than 0.05% (0.01% if possible). The reason I was going for SMs is I can get them in very tight tolerances. Once the lab gave me a value, I could then get very, very close with the SMs without having to go back and bother them for more measurements.

I don't know what GR used in the original cap. I emailed with the original designer (Henry Hall) and he seemed to recall it used a combination of cap types to keep the tempco as constant as possible. I think it uses polystyrene as one of the types but not sure about that.

Date: Mon, 9 Jan 2012 07:30:54 -0600
From: "chacuff" <chacuff@cableone.net>
Subject: Re: [R-390] "unwarranted overstatement"

I have to agree on this one....

We have been rebuilding these old war horses with OD caps or their

equivalents for decades and I can't remember one performing any worse after
the application than before. I've never found one with odd ball performance
characterists, weird oscillations, degraded audio or degraded RF performance
or any thing one might attribute to the wrong application of capacitor type.
I think with the improved technology of the dipped film foil caps or the modern day ceramics the work to recap the radio is always an improvement.

I'm not trying to re-open the debate related to complete recap vs selective recap here. If you do either with modern parts you have improved the radio.

Making the assertion that using ODs for bypass is the unpardonable sin would
be no different that stating the use of ceramics for coupling caps in the SP-600 to be the same. The factory did it and it still met performance specs. Could the audio performance of the SP-600 be improved by the use of OD in the coupling role....Maybe so...I don't know.

At the end of the day one should ask....did the work I performed replaceing the caps, whatever modern parts were used, improve the radio, fix a problem,
extend the useful life of the radio for years to come....did I gain memorable pleasure from the work performed and the resulting use of the radio afterwards?

If you can answer yes then you have accomplished all that is necessary of you, the temporary owner of this piece of history. Hopefully from the experience you will be driven to rescue more of them and others like them such as the SP-600, Racal RA-17's and any number of tube related gear.

I mean heck...if i'm going to be committed to the nut house for the possession of way too much of this stuff I want to go with my buddies right...so we'll all have something to talk about when we get there.... No Foul detected here....

Cap on....(like Nike says) Just do it!

Date: Mon, 9 Jan 2012 12:22:19 -0600
From: Ben Loper <brloper@gmail.com>
Subject: [R-390] Replacement Caps

I've been working on a 75A-2 for awhile now restoring it and I've been thinking all along I would use Orange drops. I pulled out the 75-A2 parts list and it seems just about all of the the .01 uf caps are ceramic 350 WVDC and anything larger than that is a paper cap. I think I'm going to order a batch of .01 500v ceramic caps and use axial lead poly caps for the larger ones and then Spraque electrolytics for the positions that call for them. This may be a simplistic view but I know cost figured into the design. Anyway my thinking is that the original radio worked great and I'm just going to replace the original parts as they were spec'ed out. The paper has just been upgraded to poly materials. I like the Orange drops, but because they are radial leads they don't always fit as well as an axial lead cap. I know I tend to over analyze things, wanting to find the absolute best part, but I think unless a specific part was spec'ed wrong or has clearly failed then the original is fine. That's my two cents worth and it's not intended to imply anyone is not correct in what they've posted.

Date: Mon, 9 Jan 2012 18:47:04 +0000
From: <kirklandb@sympatico.ca>
Subject: [R-390] Silver Mica versus C0G/NP0 ceramic ?

Any thoughts on silver Mica versus C0G/NP0 ceramic ? One data sheet I am looking at shows C0G as having 0 ppm/C +/- 30 ppm wheres silver mica are -20 to +100 ppm/C (depending on value). C0G is stated as having no shift in capacitance with voltage similar to silver mica

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Date: Mon, 09 Jan 2012 17:50:20 -0500
From: "Charles P. Steinmetz" <charles_steinmetz@lavabit.com>
Subject: Re: [R-390] Paper Capacitor Replacement II

>So, an all-polystyrene "array" would be best?

Yes, aside from temperature compensation and any need for operation at VHF or above (not likely with a 0.5 uF cap, eh?).

>I found some 0.047uF @ 1000V. Ten of those in parallel.....

Only temperature compensation, which it would be relatively difficult for an amateur in a home lab to organize without a substantially better bridge or C-meter than the one being repaired -- which I gather is not your situation. Polystyrene capacitors typically have tempcos of -100 to -300 ppm/degree C, so you should be able to hold +/- 0.1% over at least +/- 3 degrees C above and below the temperature at which they were measured -- acceptable for a lab instrument. You may want to let the bridge warm up fully and measure the temperature inside, and ask the lab if they can measure your cap at that temperature.

BTW, correction factors are a fact of life in the calibration world. Don't be scared of them. Just keep a pocket calculator handy.

I'm curious where you found your 1000v polystyrenes, and what brand they are. (I like the Eurofarad polystyrene caps, but I don't know if they make anything above 500v. ACC does, but only to order.)

Date: Mon, 09 Jan 2012 17:56:20 -0500
From: "Charles P. Steinmetz" <charles_steinmetz@lavabit.com>
Subject: Re: [R-390] Silver Mica versus COG/NPO ceramic ?

>Any thoughts on silver Mica versus COG/NPO ceramic ?

For what? (As you noted, COG has a better tempco than silver-mica. What other characteristics are important in your application?)

Date: Mon, 9 Jan 2012 20:44:49 -0500
From: bill kirkland <kirklandb@sympatico.ca>
Subject: Re: [R-390] Silver Mica versus COG/NPO ceramic ?

The COG ceramics cost quite a bit less than silver mica and from a quick review of the specs appear to be as good or better than silver mica

- temp comp equivalent or better
- voltage stable, ie. Value doesn't vary with voltage (only COG)

So if a silver mica was used in the old gear why not replace it with a COG ceramic? -e.g. oscillators, tuned circuits, IF transformers.

Date: Mon, 09 Jan 2012 22:19:56 -0500
From: "Charles P. Steinmetz" <charles_steinmetz@lavabit.com>
Subject: Re: [R-390] Silver Mica versus COG/NPO ceramic ?

The two parameters you mention -- tempco (temperature coefficient of capacitance) and voltage coefficient of capacitance -- are only two of a myriad of capacitor characteristics. Both are frequently of little import (lots of circuits wouldn't show any perceptible difference if the capacitance varied by a factor of 5 up or down). Two that are often of great importance are dielectric absorption and dissipation factor. The choice of capacitor depends on which of these many parameters are most important in the particular application.

For general tuned circuit duty where temperature compensation is not required, COGs are fine capacitors. (Although COGs have a near-zero tempco, inductors and crystals most assuredly do not -- so, ironically, by using the "better" near-zero-tempco part, you are guaranteed of having

greater temperature sensitivity in the circuit than if a capacitor with an appropriate non-zero tempco were used to compensate the overall circuit tempco.) For oscillators, you will almost always want capacitors with a particular tempco, to offset the tempcos of other components. There, you would choose from the "N" and "P" series of ceramics (for example, the N750 series has a negative temperature coefficient of nominally 750 ppm/degree C).

Some choices are driven by practical considerations, such as what manufacturers produce. One advantage of silver micas is that they are readily available in tight tolerances (1%, 0.5%, 0.25%). Not so with ceramics of any kind, including COGs. There is also not as good a selection of COGs at 500 V and above as there is with micas.

Date: Tue, 10 Jan 2012 14:59:23 +0000
From: <kirklandb@sympatico.ca>
Subject: [R-390] Info on Capacitors

I came a cross a good discussion on capacitors at
http://www.analog.com/library/analogDialogue/Anniversary/21.html

There is more from a solid state point of view though. One point I found particularly interesting is that: dissipation factor also turns out to be the equivalent to the reciprocal of the capacitor's figure of merit, or Q, which is also sometimes included on the manufacturer's data sheet.

Date: Tue, 10 Jan 2012 20:45:59 -0500
From: "Dave Maples" <dsmaples@comcast.net>
Subject: Re: [R-390] Info on Capacitors

All: I have one more question about capacitors, and it's related to the discussion about metallized film vs. foil-and-film caps. At least one if not more than one person on the list indicated that the metallized film caps should never be used above a small fraction of their rated working voltage.

I read what I could find easily on self-healing, but the difficulty I'm having is this: These things are sold and used in commercial gear where failure to meet specs leads to liability lawsuits in a very large hurry. If they aren't suitable at more than a fraction of the rated DC working voltage, how do the cap mfrs. stay in business? What am I missing here? If it's a dumb question, I'm happy to be called dumb as long as I learn something.

Date: Tue, 10 Jan 2012 21:07:49 -0600 (CST)
From: nryan@mchsi.com
Subject: Re: [R-390] Info on Capacitors

Great discussion going on here re capacitors.

The "self-healing" feature is small comfort for the R-390A's C553 capacitor. That's the one which will take out your mechanical filters one by one if it shorts or leaks. I use the Sprague/Vishay 715P (.01 uF @ 600VDC) and hope for the best. Replacement (used) mechanical filters have virtually dried up on the market, so be forewarned herewith.

The BBODs routinely get replaced as almost of them all leak. With the exception of C553, mentioned above, I retain the metal encased paper-in-oil capacitors as they usually test good. C603 and C606 (plug-in electrolytics) we already know about -- monitor closely or restuff/replace them. C609 (tantalum 8 uF @ 30VDC) frequently is found deteriorated. Faulty silver micas are hard to pinpoint much less test in place. Ceramics do well although I recently replaced a faulty C410 (.005uF @ 1KV). Are there other capacitors to be especially vigilant about?

Date: Thu, 12 Jan 2012 21:57:02 -0500
From: Barry <n4buq@knology.net>
Subject: [R-390] Another Capacitor Question

This question concerns voltage ratings.

In this application, the system can apply up to 600VDC across the capacitors (several in parallel). I happened on some 1000V polystyrenes for the bulk of the 0.5uF and need to finish with some smaller value polystyrenes. I can get some 1000V capacitors for this, but they're pricey ($10 each in lots of two). I can readily get 630V polystyrenes, though.

Is this too close to the max rating? I usually get capacitors rated at well beyond the anticipated applied voltage (1.5x or better) and would do so here if it weren't for the lack of reasonably-priced units.

Date: Fri, 13 Jan 2012 15:25:25 -0600
From: Tisha Hayes <tisha.hayes@gmail.com>
Subject: Re: [R-390] Another Capacitor Question

Some people are perfectly willing to run right up against the rated values on components. I really do not feel comfortable on doing that and usually when I am approaching +/- 10-15% of whatever value (capacitance, resistance, voltage, wattage, etc...) I am usually upsizing the component.

Much of it depends upon duty cycle, the criticality of the application and the inherent risk of the device. Since a capacitor is an energy storage device that can fail catastrophically and cause cascading failures in other

components my personal inclination would be to go with a 1000 V component.

You still may be able to use those 630 V capacitors if you create a series/parallel combination of caps to get to the desired capacitance value. You would end up with a capacitor array that would be rated for a max voltage of 1260 volts and take up four times the number of components (and space) to do the same thing. It does depend upon what sort of deal you got on pricing/ availability (eg.. if it is in my parts box it is essentially "free" to me and I do not worry about the cost).

Running a 630 volt capacitor in a 600 volt system... yea, you probably will be able to get away with it and 95% of the time it will never become an issue. For me, it is the 5% of the time that gets me antsy feeling.

Date: Fri, 13 Jan 2012 16:42:41 -0500
From: "Charles P. Steinmetz" <charles_steinmetz@lavabit.com>
Subject: Re: [R-390] Another Capacitor Question

Is the 630 V a DC rating? 630 V is most commonly an AC rating, which does not translate directly to any particular DC rating (AC rated caps are generally rated for DC voltages much lower than the AC rating). In the case of polystyrene caps, an AC rating means that the intended use is in high-Q resonant circuits, which can generate hundreds or thousands of volts with a DC power supply voltage of 24 V or less. Even if the 630 V is a DC rating, that is uncomfortably close IMO -- it would only take a line voltage excursion of +6 V to put you over the edge (and remember that today's typical line voltages are already 5-10 V higher than they were when your bridge was made). The original cap was rated for 800 Vdc.

You are rebuilding a very nice piece of test equipment history – get the 1000 V caps and stop trying to cheap out! ;-)

Date: Fri, 13 Jan 2012 16:23:49 -0600
From: "Alan Chandler" <alanchandler@frontier.com>
Subject: Re: [R-390] Another Capacitor Question

For high voltage caps, try mouser www.mouser.com . They have 1000Volt
polyester caps from $.54 to $1.36 depending on value. Also no minimum.

Date: Fri, 13 Jan 2012 17:44:00 -0500
From: "Charles P. Steinmetz" <charles_steinmetz@lavabit.com>
Subject: Re: [R-390] Another Capacitor Question

For a precision capacitance bridge, you want caps with better DF and DA

than PE caps.

Date: Wed, 11 Apr 2012 17:55:44 -0400 (EDT)
From: chuck.rippel@cox.net
Subject: [R-390] More "Must Replace" Caps

With the IF deck upside down and the bandwidth and BFO shafts facing you, C529 is a .033 ufd capacitor mounted right hand forward, on the side of the IF deck chassis right behind V504 on stand-off's. This cap bypasses the screen of V504 and with screen voltage on one side and ground on another, is a prime candidate for leakage.

Add this to your "must replace" list using a .033 600VDC tubular. While "you're there," also replace C528 mounted just above it with .1ufd @ 400 or 600V. Its the cathode bypass cap for the same tube. Be VERY CAREFUL not to overheat or break the now brittle stand-offs.

You folks whose radio I am either working on or will work on, will have this done "automatically."

If you're in the RF deck, make sure you have a 100pf, 600V or better yet, 1KV ceramic disc on hand to replace (always) C327, across the primary of T207. After replacement, be sure to re-tune T207. Just had an e-mail exchange with an owner experiencing low 1st oscillator output. Named several possibilities but have seen C327 fail before. Its been on my rather large list of "must replace" caps for some time. Again, if I'm doing your radio or have worked on it in the last 10 years, that cap has been replaced.

A question to the group. Anyone have documentation on how to tune T401
on the 2nd xtal oscillator deck? I've never found any documentation on that. Got a few ideas on how that MIGHT work but nothing firm. It's interactive with all the ceramic caps used to peak the individual xtal outputs. Its my GUESS those caps are pre-set to a certain capacitance then the coil is peaked, perhaps at the lowest fundamental xtal frequency then the caps for each band(s) are subsequently peaked. That's not gospel, I've not tried it, don't turn your radio into a brick by experimenting. Lets try and find out. Chuck Rippel

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Date: Mon, 4 Feb 2013 07:55:53 -0800
From: "Craig Heaton" <hamfish@efn.org>
Subject: Re: [R-390] Filters

Something more than the Fluke will be needed to test C551, more to the point
it has to be tested at rated voltage. In this case 500V. Both of the R-390/A's in my shack have had C551 replaced, their insulation resistance was zip, nada, zero. The Sprague TO-6A analyzer showed the value (2MF) was close but failed on IR. A new cap can be placed under the chassis; NTE makes a mylar cap which will fit inside old can.

Date: Mon, 04 Feb 2013 11:16:27 -0500
From: rbethman <rbethman@comcast.net>
Subject: Re: [R-390] Filters

I simply used a disk ceramic rated for 1KV. Just put it in after removing original. Used teflon spaghetti.

Date: Mon, 04 Feb 2013 20:30:25 -0500
From: "Charles P. Steinmetz" <charles_steinmetz@lavabit.com>
Subject: Re: [R-390] Varying gain [WAS: Filters]

>I've got all replacement caps coming for C551 as well as all the
>bypass and coupling caps. The Orange Drops I put in the other
>module were so large, I opted to buy smaller radial Panasonic ones
>for this module. The ODs make it nearly impossible to work on.

As has been pointed out before, the film capacitors in tube equipment should really be "film-and-foil" types rather than the smaller metallized film caps. Most especially, C551. (For the reasons, consult the archive -- the search terms "self-healing" or "self-heal" may be helpful, as well as "film-and-foil".) <snip>

Date: Mon, 4 Feb 2013 22:57:22 -0500 (EST)
From: Barry <n4buq@knology.net>
Subject: Re: [R-390] Varying gain [WAS: Filters]

Others may have a clearer explanation of the "whys" for not using metalized foil, but as I remember the discussions, these caps "heal" themselves when a defective area in the dielectric is destroyed by a very temporary short between the adjacent films. It is this process that can be detrimental to other components - in this case, the filter(s).

Date: Tue, 5 Feb 2013 05:48:42 -0600
From: Tisha Hayes <tisha.hayes@gmail.com>
Subject: Re: [R-390] Varying gain [WAS: Filters] (self healing caps)

Self healing caps will rely upon supplying some amount of current across the cap to "pop" a shorted area open. (like a pimple). I suspect the thinking is that you definitely do not want any sort of current flowing through the filter bobbins. They are wound with such fine wire they are extraordinarily sensitive to cooking a winding open.

Then again we do not need to be putting a Sprague 715P, 600 volt cap in there when a '225 would work (different grade of Sprague Orange Drop capacitor). Just about anything we put in there is going to be better than some BBOD (black beauty of death).

We attach too much significance to "premium" capacitors in every application in the receiver. Putting 600 volt ''715P's in some B+ bypass application where it will never see more than 220-250 VDC is overkill. There may be 4-5 spots in the receiver where a higher end cap would make a difference (that "IF filter Killer Cap" and a few spots in the audio chain). It has gone from practical to mystical and the "mor is betta" approach seems to take hold. <snip>

Date: Tue, 5 Feb 2013 09:49:19 -0500
From: "quartz55" <quartz55@hughes.net>
Subject: Re: [R-390] Varying gain [WAS: Filters] and archives

<snip> As far as the IF caps, I do have the OD in the filter in and out coupling caps. I was going to use the metalized for the rest of the bypass and coupling, and since they are 800V, I'm hoping they won't have any 'pimples'. I did use Xicon Poly Met 400V axial ones in the AF module, mostly because of their small size. The ODs just won't fit on the AF board TB601. <snip>

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Date: Wed, 24 Apr 2013 11:38:56 -0700
From: Gordon <gordon@n6wk.com>
Subject: [R-390] Orange Drop Caps vs Film Polyester Axial

I was curious why one couldn't use these Caps when recapping the 390 in place of the orange drop .01 Caps
http://www.mouser.com/ProductDetail/Cornell-Dubilier/150103J400BB/?qs=sGAEpiMZZMv1cc3ydrPrF%2fUH96ueUpCvDrd5gCiryOM%3d These seem like a natural replacement since they are Axial leads.

Date: Wed, 24 Apr 2013 14:05:37 -0500
From: Cecil <chacuff@cableone.net>
Subject: Re: [R-390] Orange Drop Caps vs Film Polyester Axial

You can...just don't get your soldering iron up against the cap when soldering in tight spaces...they are very unforgiving if the heat.

Date: Wed, 24 Apr 2013 15:46:07 -0400 (EDT)
From: bonddaleena@aol.com
Subject: Re: [R-390] R-390 Digest, Vol 108, Issue 18

I have several Collins radios at present. I had several R-388s in the past and they are AMAZING radios for the time and even today. Currently, I have a 51J-3 which is the civilian version of the R-388. I use it with an outboard SSB adapter and it's really sensitive. Also have a nice EAC R-390A. The 75A-4 needed a lot of work to get it performing but it's also a 'keeper'. When the paper dial drums are replaced, these old radios sure look good, too!!

Date: Wed, 24 Apr 2013 15:59:52 -0400
From: "Charles P. Steinmetz" <charles_steinmetz@lavabit.com>
Subject: Re: [R-390] Orange Drop Caps vs Film Polyester Axial

The C-D caps in the link you provided are metallized film, which have serious drawbacks for use in tube equipment. There is lots on this in the archives -- use "film-and-foil" and "self-healing" as search terms, along with "orange drop".

Date: Wed, 24 Apr 2013 13:28:17 -0700
From: David Wise <David_Wise@Phoenix.com>
Subject: Re: [R-390] Orange Drop Caps vs Film Polyester Axial

If you meant R-390A not R-390, maybe the best choice for C553 is a Y-rated safety cap. Designed to open (not short) if it fails. What do you think?

Date: Wed, 24 Apr 2013 17:50:54 -0400
From: Bob Camp <ham@kb8tq.com>
Subject: Re: [R-390] Orange Drop Caps vs Film Polyester Axial

You can't use them because they aren't as cool. Other than the "aura" attached to orange drops, no reason not to use the CD caps. The only real downside is that they are a bit less tolerant of being bumped with a hot soldering iron.

From: "Drew P." <drewrailleur807@yahoo.com>
Subject: Re: [R-390] Orange Drop Caps vs Film Polyester Axial

"The C-D caps in the link you provided are metallized film, <snip>

At issue is the self-healing action, which consists of momentary short circuit between the capacitor's "plates", followed by vaporization of a small portion of the very thin metal layer. It would seem that at some low voltage this would not occur, and so we might use caps rated for, say, 800V in a typical receiver application where the voltage encountered is much lower. Would this approach have merit?

Date: Thu, 25 Apr 2013 01:31:18 -0400
From: "Charles P. Steinmetz" <charles_steinmetz@lavabit.com>
Subject: Re: [R-390] Orange Drop Caps vs Film Polyester Axial

My own tests, and those of others whom I trust, indicate that metallized film capacitors exhibit unacceptable self-healing events at impressed voltages of 200Vdc or less, regardless of their voltage rating. On the other hand, unacceptable self-healing events have NOT been observed at impressed voltages of 50Vdc or less with metallized film capacitors rated at 50Vdc and above. So, I use metallized film capacitors in SS designs but not in tube circuitry.

Date: Thu, 25 Apr 2013 07:28:02 -0400
From: Bob Camp <ham@kb8tq.com>
Subject: Re: [R-390] Orange Drop Caps vs Film Polyester Axial

Let me throw another wrench into this.

There is an enormous knock off industry out there. I have very little concern for the stuff that Mouser or Digikey sell. Stuff I get at a ham fest, who knows. Stuff from the auction sites - worth looking at very closely. I've received several batches of parts that didn't look quite right, and they were indeed not right.

Date: Thu, 25 Apr 2013 07:51:34 -0600
From: Doug Massey <dougmassey@masseyradiolabs.com>
Subject: Re: [R-390] Orange Drop Caps vs Film Polyester Axial

Don't buy any components say other than tubes from hamfest or auction sites. I believe most of it is junk. I agree stick with reputable source like mouser etc for your component parts I have never seen prices at a hamfest that were much cheaper anyway!

Date: Thu, 25 Apr 2013 10:23:05 -0700 (PDT)
From: Johnsay Johnsay <groundwave@yahoo.com>
Subject: [R-390] Caps

I actually enjoy esoteric discussions about components. Not much of this

was covered in school. There is a pretty good discussion on the subject of film caps in Wiki. I had planned to replace most of the caps in my '54 Motorola R-390A with 400WVDC Panasonic PP metalized film caps. Although conservatively I was going to use a 600WVDC PP film cap "Sprague OD" for the filter coupling cap. Has anyone experienced failures with caps such as these used for replacement purposes?

Date: Thu, 25 Apr 2013 12:30:39 -0700 (PDT)
From: wli <wli98122@yahoo.com>
Subject: Re: [R-390] Orange Drop Caps vs Film Polyester Axial

For the labor involved in replacing capacitors, it seems to me to be false economy to buy discount or surplus. Your time is better spent buying new reliable components and not worrying about crummy components.

Date: Thu, 25 Apr 2013 15:39:42 -0400
From: rbethman <rbethman@comcast.net>
Subject: [R-390] Replacement Capacitors

The only ones I have EVER used were those capacitor kits that Dave Bingham was putting together.

I do not believe that anyone ever had issues with those kits!

Date: Thu, 25 Apr 2013 12:46:10 -0700
From: Gordon <gordon@n6wk.com>
Subject: Re: [R-390] Replacement Capacitors

When I asked the Question regarding the Polyester metalized ones, it wasn't to try and save a dime. It was to hear why everyone was suggesting the Orange Drop ones. My whole point was to try and keep it more Original by replacing Axial Caps with Axial caps. Sounds to me like many can be replaced with ceramic (by-pass) and the others it seems are to be replaced with Orange Drops. I just wish they Orange Drops were Axial leaded..LOL If the main concern is C-553 shorting and taking out the Filters, why wouldn't it be wiser to put a pair of .02 in series for extra safety in place of the one .01 ? I must say, I have sure learned a lot about the differences in Caps from this discussion. It has been a very informative Thread.

Date: Thu, 25 Apr 2013 15:59:20 -0400 (EDT)
From: L L bahr <pulsarxp@embarqmail.com>
Subject: Re: [R-390] Replacement Capacitors

The yellow axial caps work just fine. I use them all the time and never had a bad one. Some of what you are reading is nothing more then bias. Most

likely the modern yellow ones are better then the ones the manufacturer used when he built the receiver. Orange drops are fine, but so are the yellow ones and they cost less. I buy mine from www.justradios.com Good prices, fine caps and resistors and fast service. I personally don't like to use Orange Drops as they are radial caps and I like axials better.

Date: Thu, 25 Apr 2013 16:11:35 -0400
From: "Charles P. Steinmetz" <charles_steinmetz@lavabit.com>
Subject: Re: [R-390] Caps

Yes. I've tested several types of Panasonic PP caps and found unacceptable self-healing events. If you insist on using metallized film caps, the Panasonic ECWH(A) series of 800 volt parts is about as good as you can do. But why, when it is just as easy and only a little more expensive to use film-and-foils?

And again, for the vast majority of caps in any boatanchor – power supply bypass capacitors -- why would one use film caps at all? 1 kV disk ceramic caps perform better in this application and are extremely reliable, besides being small and therefore easy to install.

If one is going to invest all the time and effort to replace lots of caps, it seems only sensible to use the best parts for the job unless they are prohibitively expensive. And neither film-and-foils nor disk ceramics are.

Finally, why shotgun the caps in a 390A in the first place? There is no pattern of general failures in 390As (unlike Hammarlund SP-600s and other BAs that are notorious for cap failures). Remember, by far the greatest number of lifetime failures of capacitors (as well as most other electronic components) happen in the first few hundred hours of operation. You are at least as likely to install a cap that fails sooner than the one you removed as you are to extend the time to failure. Of course, if the particular radio has a history of cap failures, it could indicate that the manufacturer was using a bad batch of caps when the radio was built, or that the radio has experienced environmental stress in its lifetime, in which case wholesale capacitor replacement may be indicated.

Date: Thu, 25 Apr 2013 16:22:35 -0400
From: rbethman <rbethman@comcast.net>
Subject: Re: [R-390] Caps

Have you looked at a '51 contract Collins? (They came out in '54.) They are full of Black Beauties! I believe that they are an automatic replace item! It has been beat to death and shown that BBOD is indeed the appropriate name! Sprague Vitamin Qs are fine if they don't test bad, and I haven't found a bad one yet.

Later contracts such as EACs had good caps put in them to begin with.

Date: Thu, 25 Apr 2013 15:46:11 -0500
From: Tisha Hayes <tisha.hayes@gmail.com>
Subject: [R-390] Those orangey capacitors

There is an entire mystique attached to the orange drops but there need not
be. The caps we are really talking about are the Vishay Sprague (SBE) "orange drops" that actually come in a couple of different varieties: the three major models of orange drop are the 225P, 715P, 716P and 6PS series.

225P are polyester (in a flatter package than the 418P)
715P are polypropylene
716P are polypropylene (in a flatter package than the 715P, tinned copper leads)
6PS are polyester
418P are polyester

There are no-name clones that try to capitalize on the orange color. On eBay you may find that color difference means that a capacitor costs ten times more than normal.

There are differing opinions on the audio quality of amplifiers with different capacitors. Some say that polyester caps sound better. Other subjective terms like "brightness", "organic" or "fuller" sound. Remembering that many of these are used in guitar amplifiers and really those devices are not renowned for spectral purity. In fact some guitar amps intentionally add distortion to sound as part of the effect

So much of the hype about orange drops comes from the audiophile world. While there are maybe a half dozen caps in the AF chain that might have some impact upon audio quality for most other places in the R-390A a good ceramic disk works just fine. There are so many other factors that affect audio quality such as the amplifier tube, speaker/ headphone or how where you have the IF gain set to.

Probably the biggest challenge any of us will face is trying to pack a bunch of 600 volt orange drops into the tiny spaces under the IF deck.

Date: Thu, 25 Apr 2013 20:57:18 +0000
From: Mark Johnson <mvjohn@sympatico.ca>
Subject: Re: [R-390] Caps

I'm always hesitant to comment on these "replace the caps" email threads;

between the different Radio Reflectors there are hundreds of them, that would have a person "shotgun" cap changes because it is a widespread practice and I feel I'm going against the generally accepted view point.

Your last paragraph is bang on at least with me. I think there is a lot of unnecessary cap replacements that take place mostly out of fear and because a lot of people use this as a trouble shooting approach vs developing a knowledge of how the radios work and learning good troubleshooting skills. In other words, if you can't find the bug, replace all the caps.

To your point, I think the risks of creating further problems are huge. You could replace a cap incorrectly, cause a solder bridge, damage other components, etc. And of course, my favorite, the tendancey to "tack" solder in the replacement.

My R390 is still running along fine just the way she came from Collins, exception being the old rectifier that provides DC for the stdby circuit.

Personally, when I buy a boat anchor radio and the seller tells me he's re-capped the radio, I tend to offer less money as the job is usually not done correctly and I have a lot of work to do to back out the ugly work.

Just my thoughts. Thanks for your comments Charles.

Date: Thu, 25 Apr 2013 17:37:08 -0400
From: "Dave Maples" <dsmaples@comcast.net>
Subject: Re: [R-390] Orange Drop Caps vs Film Polyester Axial

Charles: Can you put some meat on these bones, please? How is "unacceptable self-healing event" defined? What were the test conditions (e.g. test setup, capacitor value, etc.)?

Date: Thu, 25 Apr 2013 17:51:41 -0400
From: "Dave Maples" <dsmaples@comcast.net>
Subject: Re: [R-390] Replacement Capacitors

Gordon: Orange Drops used to be axial-lead caps--about 40 years ago. They
became radial-lead when everything moved to being PC-board construction.

List: If anyone here can define a real source for axial-lead, film-and-foil capacitors I'd be very interested. I've used the axial-lead metallized-film caps from Illinois Capacitor for several projects and have been pleased; however, based on some of the discussion I wouldn't mind paying a

LITTLE more for film-and-foil IF they are really available. I won't pay audiophile prices. I did one R-390A with ODs and was displeased with how they installed, because current ODs just aren't axial-lead caps. I won't do another one with them.

Date: Thu, 25 Apr 2013 17:20:26 -0500
From: Cecil <chacuff@cableone.net>
Subject: Re: [R-390] Caps

There are definitely two camps on this...and that's ok..because I only have to look after the radios I own and not everyone else's. I will say that I am from the "replace all the paper caps" camp. But to be fair I have to state that it is not as a troubleshooting method...neither is my replacing resistors that are out of spec. But it does in many cases result in improved performance. I can honestly say that I have never found a paper cap that I removed from an R-390A that didn't fail a leakage test at rated voltage on my trusty Sencore cap analyzer. Now before you reach for that enter key... I know many are used in circuits that don't subject the caps to rated voltage...but I have to believe that if the cap has degraded to the point that it fails at rated voltage how long will it continue to function properly before it degrades to the point that it fails at operating voltage. It is a progressive disease. They are slowly changing from caps to resistors.

On the subject of resistors...those are often overlooked and are every bit as important to the proper function of the radio as the caps...and maybe more so.

And just for the record...all my radios didn't come out of the St. Julian's Creek pile...this effects all radios of this vintage that use the same quality of parts..

The notable exception to my "change all paper caps" rule is the R-390/URR. It used top quality parts and rarely needs its paper caps replaced...I never do wholesale change outs in those..it's truly not proven to be necessary....that's not to say they don't fail...just not often.

Date: Thu, 25 Apr 2013 18:26:28 -0400
From: "Charles P. Steinmetz" <charles_steinmetz@lavabit.com>
Subject: Re: [R-390] Replacement Capacitors

>.....why wouldn't it be wiser to put a pair of .02 in series .....

No reason not to, and it could extend the MTBF if one cap had an early failure. Of course, you wouldn't know that one had failed, so the end result (when the second one failed) would be the same – one or more open filters. But any good-quality film-and-foil capacitor bought new today is very

likely to outlast you and the next five owners of the radio, at the least.

Lee wrote: Some of what you are reading is nothing more then bias.

Since I'm the one asserting the superiority of film-and-foil caps in tube equipment this time around, I presume you are referring to my comments. My view is based on decades of observation of failure modes and rates of capacitors in manufactured tube products, and follow-up testing of hundreds of new capacitors made by reputable manufacturers obtained through the primary supply chain. So call it bias if you want to, but if so it is bias based on a lot of objective observation and testing.

Tisha wrote: So much of the hype about orange drops.....

There may be a preference for ODs among some audiophiles because of their perceived sonic characteristics, but that has nothing to do with the reason I'm advocating using film-and-foil caps rather than metallized-film caps in tube equipment. The reason for the latter is reliability, due to the inherent nature of metallized-film caps.

Date: Thu, 25 Apr 2013 15:43:49 -0700 (PDT)
From: wli <wli98122@yahoo.com>
Subject: Re: [R-390] caps

Well, the BBOD's in my R390A's have all leaked when tested at 250v using the previously published method of employing a 11M VTVM in series with the HV supply. So count me in the camp of global replacement of all of those 60 year old paper caps. Not one SBE Orange Drop has failed on me. No question, fitting OD's in the IF deck is not easy, but if you think ahead and take your time, it is entirely possible. Once done, I can move on to other stuff. W. Li

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Date: Thu, 25 Apr 2013 19:28:41 -0400
From: Bob Camp <ham@kb8tq.com>
Subject: Re: [R-390] Replacement Capacitors

Next wrench into the process: What awful things happen if it shorts?

If it's a cap to ground, in general the answer is "not much". Yes there are a few exceptions, but in general there is no massive belch of smoke from any vital part of the radio. Replace the cap and all is well. Many of the 0.1 uf caps fall into the cap to ground category. Now, could you fry a resistor? Yup, you might. Most of what I've looked at is in the *nope* category. I haven't found a puff of smoke resistor, but it may be in there. To me, resistors aren't in the "can't replace it" category. Filters and transformers are in the gotcha category.

At least by my count there are far more caps in the don't sweat in category than in the lost a radio category.

Date: Thu, 25 Apr 2013 21:03:36 -0400
From: "Charles P. Steinmetz" <charles_steinmetz@lavabit.com>
Subject: Re: [R-390] Replacement Capacitors

>What awful things happen if it shorts? <snip>

The gotcha with B+ bypass caps is that you can lose a filter choke (as well as rectifiers and resistors, but, as you note, those are not the end of the world). I have seen this happen more than a few times, including to one of my own radios. Replacement chokes can be very difficult to find.

Date: Thu, 25 Apr 2013 21:12:13 -0400
From: "quartz55" <quartz55@hughes.net>
Subject: [R-390] Caps

I used all OD's in one IF module. I thought it was overkill and way too busy and crowded. I managed to unwind all the old stuff and wind the new ones back on, took me at least a day.

The next IF, I used metalized film in everything except the filter caps where I used OD. I thought that was much easier, cleaner and a good comprimise, at least for me. Now I guess I'll find out if the metalized film give up on me maybe in the next 10 years or so, after that it's someone else's problem. I have a whole bunch of OD if anyone wants them at a good price. Now to get the filters finished. Dave

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Date: Thu, 25 Apr 2013 20:38:58 -0500
From: Cecil <chacuff@cableone.net>
Subject: Re: [R-390] Replacement Capacitors

These are go-no-go situations...what about the caps that develop series leakage resistance and just slowly drag performance down....I think there are more old radios suffering from this unattended issue than anything...and also caps that seem to go from .01uf to 100 pf or some such and don't do their jobs of bypassing or coupling and result in poor performance...

Most won't know about these because they don't result in smoke or blown fuses but generally sneak by as a marginally performing radio.... Just went through a Racal RA17 with a bunch of that going on...spectacular radio after the work.

Date: Thu, 25 Apr 2013 22:17:19 -0400 (EDT)
From: Roger Ruszkowski <flowertime01@wmconnect.com>
Subject: Re: [R-390] Orange Drop Caps vs Film Polyester Axial

W. Li. amen brother. After you spend an hour getting a deck out and the iron hot why not plan ahead and just have some quality parts to install. Mostly its a problem of finding a brand that we consider to be of quality to start the process.

Date: Fri, 26 Apr 2013 14:07:40 +0000 (GMT)
From: chuck.rippel@cox.net
Subject: [R-390] C553

Put in a single 600VDC Orange drop.
It'll work fine during the lifetimes of you and your kids.

Date: Fri, 26 Apr 2013 08:32:41 -0700
From: Gordon <gordon@n6wk.com>
Subject: Re: [R-390] Caps

Thanks Chuck, that is exactly what I did !

Date: Fri, 26 Apr 2013 18:15:44 +1000
From: Ken Harpur <igloo99nz@yahoo.co.nz>
Subject: Re: [R-390] Replacement Capacitors

I am in favour of replacing all the paper caps...my attitude is 'do it once, do it right'. After recapping my radio I like the peace of mind from knowing I'll never have to touch those caps again...rather than just replacing the obvious leaky ones only to sit back and wait for the next one to go bad...

I did a full recap of one of my R-390As, I ended up having to replace many of the mica caps too as they were bad. It's made a very noticeable difference in performance although sensitivity on some bands is a lot worse than others...for that I am suspecting the crystal osc deck...

But anyway...I used the 716P caps and I have to say I don't want to use them again...I just don't like the way they look in there. So I have been trying to find an axial Polypropylene Cap. I'll never use metalised film in tube equipment for the reasons that have already been outlined in previous posts.

Sometimes trying to do research in the archives can do your head in...in some cases there is conflicting information or schools of thought (not dissimilar to this cap discussion)...one example is the topic of the Aerovox caps as used in EAC R-390As...some say they are good caps that generally

don't go leaky while others say most of them in their EAC receivers were bad. Another one is the infamous cap for the Filters...everyone generally agrees that this should be replaced because it is now deemed unreliable, yet the same type of cap is used in the R-390 (non-A) and it is generally accepted the caps in the 390 were of good quality and don't require replacement.

An idea I thought of recently was to try using either Ceramic or Mica caps as replacements for the bypass Paper caps and Polypropylene for the coupling caps...finding values high enough might be a challenge though...

Date: Fri, 26 Apr 2013 07:17:33 -0400
From: Bob Camp <ham@kb8tq.com>
Subject: Re: [R-390] Replacement Capacitors

The old paper / paper oil / paper plastic oil caps do slowly develop leakage. They can be a real issue on things like the AGC line. I have not seen any evidence of a slowly building leak in the plastic parts. If it happens, it's rare.

There is an interesting tradeoff with the otherwise "really really good idea" ceramic caps. Even if you go to the X7R dielectric (which you should), their leakage is higher than most plastic parts. It's not something I would worry about, there's also leakage from dust and that spider web there. I don't believe the insulation resistance leakage is going to mess anything up, either with the ceramics, or between varieties of plastic.

Date: Fri, 26 Apr 2013 08:55:05 -0700 (PDT)
From: wli <wli98122@yahoo.com>
Subject: Re: [R-390] caps

Cecil makes an important observation. The functional consequences of a leaky capacitor are of paramont importance, more so than color, form factor, or internal construction. As examples, weird AGC behavior, distortion, and low sensitivity have all been traced to deteriorated aged components.... of which caps are just one.

As Nolan Lee once remarked, it all comes down to what do you want in your shack. A functional unit that you can enjoy and use daily, or something you can brag about as looking all *original*. Me, I just want it to work. Thanks, W. Li

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Date: Fri, 26 Apr 2013 13:42:01 -0400
From: "Charles P. Steinmetz" <charles_steinmetz@lavabit.com>
Subject: Re: [R-390] caps

>As Nolan Lee once remarked, it all comes down.....

One can also ask, WWACD? (What would Art Collins do?) If faced, today, with the choices we are discussing, does anyone believe for a second that The Ghost of Art would choose anything other than the best-performing currently-available parts to rebuild his 390/390A?

Date: Fri, 26 Apr 2013 15:17:19 -0400
From: "Todd, KA1KAQ" <ka1kaq@gmail.com>
Subject: Re: [R-390] caps

Most likely Art would say 'What in hell are you still using that thing for? as he was not one to dwell in the past. He was always chasing the next big thing, which it could be argued is what got him to the Rockwell deal. He was all about ICs and technology we take fro granted today, but was just a little ahead of his time.

I'm as tight as the next guy with my hard-earned dollars, but never bought into the false economy of buying Brand X to save a few cents. 'If it ain't broke, don't fix it' is a good maxim to live by. So long as you realize that 'broke' can translate to 'still works to some extent'. I'm not a fan of changing every cap in a receiver "just because", at least not from a shotgun approach. Old components do age to the point of needing replacement, but checking them first is always a good idea unless there is visible damage. And if you simply must change every single part, it's wise to do one section, stage, circuit at a time - then check your work. Can't recall how many sets I've seen for sale with a "mystery problem" that someone had shotgunned, and screwed up. It's hard enough to look at your work and see a problem to start with - why compound it with multiple possibilities?

Date: Fri, 26 Apr 2013 15:55:22 -0400
From: "Charles P. Steinmetz" <charles_steinmetz@lavabit.com>
Subject: Re: [R-390] Replacement Capacitors

<snip> go to the X7R dielectric <snip>

As you say, nothing to worry about. The starting leakage of ceramic caps is much too high to have any practical effect in bypass applications. As long as the leakage does not increase over time, as it does with paper caps, there is no problem. All "Class 2" disk ceramics (even those with lesser specifications than X7R, e.g. Z5U) have a well-proven track record in this regard. If a radio has been underwater for a long time (months to years), the ceramic caps may get leaky enough to pose a problem. Otherwise, they are very reliable.

I agree that X7R is the dielectric of choice for supply bypass capacitors, given a choice. The reason to prefer X7R over other Class 2 ceramic caps is that they hold their capacitance value better at high temperature, over time ("aging effect"), with higher applied voltage, and at higher frequencies. For example, an X7R cap is specified to be within 15% of its 25C value from -55C to 125C, while
a Z5U cap is specified to be within +22% and -56% of its 25C value from 10C to 85C. An X7R cap may decrease in value by ~10% over time, while a Z5U cap may decrease in value by ~20% over time. However, for real-world use as a supply bypass in boatanchors, one can offset these effects by using two Z5U caps in parallel in place of an X7R. (One Z5U of double the value should also work, but will bring the self-resonant frequency ("SRF") down by about an octave compared to the two smaller caps in parallel.) The leakage of X7R and Z5U caps of a given value and voltage rating is approximately the same, and is entirely negligible in supply bypass applications.

Date: Fri, 26 Apr 2013 20:19:23 -0700 (PDT)
From: wli <wli98122@yahoo.com>
Subject: Re: [R-390] caps

One thing that few do, but all should do, is keep a detailed log of everything and anything performed. My neighbors who work at Boeing are required to do it at work, and I adopted the same policy at home. Each receiver has its own section in my 3 ring binder, and it makes for a good reminder to me months later of what I did or did not do. It was of particular value when I graded tubes.

Date: Fri, 26 Apr 2013 23:24:23 -0400
From: Roy Morgan <k1lky@earthlink.net>
Subject: Re: [R-390] Replacement Capacitors

> The yellow axial caps work just fine. <snip>

Another additional safety measure is to TEST each cap before you use it. Maybe at the rated voltage or twice that even. I worked at a company (Teradyne) that made (still makes) highest quality automatic test equipment. They tested EVERY component they used before it went to the stock room. Every one. Here is why:

Cost to test a resistor or transistor: nearly zero
Cost to find a bad transistor after board testing stage: $18.65
Cost to find it after it fails at the customers factory: $367.00 or more

Of course, the company made test equipment so they used their own products to do the testing.

Date: Sat, 27 Apr 2013 08:30:50 -0400
From: Bob Camp <ham@kb8tq.com>
Subject: Re: [R-390] Replacement Capacitors

One more wrench: back when R-390's were running down the production line, there was a significant difference between dielectrics in terms of cost. These days, not so much in some cases. You need to look at what they are selling you.

If you go to Mouser and do a sort on 0.1 uf 1,000 V ceramic caps, leaded, in stock, you get 11 matches. The lowest cost part is from AVX and it's an X7R. You get to number 3 on the list before you hit a Z5U. All the rest of the stocked parts are X7R's. I'm not going to run out and pay $57 each for the ones down the list, but that's another issue.

Off to Digikey (same sort), 5 parts in stock, all X7R. Switch to 0.01 uf at Digikey. Toss out the ones I need to buy a full reel of. The first few parts are indeed unusual dielectrics, so take a look. Ok, that's -80% temperature characteristic at 85C. Next one is a -60%. First X7R is number 7 on the list. It's twice the cost of the -80% part. To get the same capacitance hot, I'd need five of the cheaper parts. If I bump up to the next one, I'd probably get away with two. At that point the "cheaper" part is actually more expensive.

Back to Mouser and 0.01 uf's. This one gets a bit tough to dig through, there are a lot of really poor capacitors on the list. The cheapest semi rational cap is about 1/2 the price of Digikey's X7R's. It's a Z5U, so you might have to use two. Mouser does not list any X7R's at 0.01 uf in single pieces.

Off to Jameco. Yup, I can get some amazingly cheap caps. House brand parts only, who knows what the characteristics actually are. Not going in my radio.

Back in the day, X7R's were 10X the price of a Z5U. X7R was mil spec, and X5U went in TV's. They may still be if I'm buying billions of parts. From the places I'm likely to get them today, there's not much (if any) cost penalty to the X7R's. If I'm not spending more on them, I see no reason not to get the good(er) stuff.

Date: Sat, 27 Apr 2013 11:32:08 -0400 (EDT)
From: ToddRoberts2001@aol.com
Subject: Re: [R-390] Caps

I once ran across an intermittent B+ short in an R-390A that was traced

to
a Brown Beauty bypass cap C545 in the IF deck, part of the plate circuit of V508.

The symptoms were the receiver would sometimes blow the 3 amp line fuse
and other times would seem to run OK, but the overall gain seemed low. This was the single line-fuse version R-390A on the rear panel. Also the 26Z5 tubes were very low on emission probably due to a constant overload.

The cap must have been very leaky at times also putting a long-term strain on the rectifier tubes. When the cap sometimes shorted it also put a direct short to ground across resistor R542 - 2200 ohms 1/2 watt. Over time the resistor went much lower in value, down to 10-15 ohms which placed almost a full short-circuit on the B+ line. This is probably what took out the 26Z5 tubes. If the receiver had the 3-fuse rear panel the B+ fuse probably would have blown protecting the 26Z5's. The owner of the radio replaced the 3 amp fuse with a 9 amp fuse which was probably the worst thing someone could do. Electronics 101 - never replace a blown fuse with a higher value! The original fuse blew for a reason!

The resistor fell apart when I unsoldered it. Apparently it was soldered in so tightly that it was forced to hold together otherwise it would have acted as a fuse also. Before I found the intermittent Brown Beauty cap it had ruined 2 sets of 26Z5 rectifier tubes. All the other Brown Beauty caps seemed fine but if ever there was a case for shotgunning caps I would definitely replace all those Brown Beauty caps in that IF deck if I had it to work on again.

Date: Sat, 27 Apr 2013 08:54:12 -0700 (PDT)
From: Mike Bracey <mikebracey@att.net>
Subject: Re: [R-390] Caps

Todd, my 390A had that exact same problem. Same cap and resistor. My short was constant. It almost drove me crazy. I had already solid stated the rectifiers.
That was God's way of telling me that the Brown Beauty's had to go.

Date: Sun, 28 Apr 2013 09:30:56 -0400
From: "Charles P. Steinmetz" <charles_steinmetz@lavabit.com>
Subject: Re: [R-390] Orange Drop Caps vs Film Polyester Axial

><snip> How is "unacceptable self-healing event" defined? What were the test >conditions (e.g.test setup, capacitor value, etc.)?

The test protocol used a slowly ramping voltage on the cap, up to its rated voltage, from a source with several hundred ohms impedance. Every self-healing event reset the voltage to zero. Every several hours there was a simulated power cycle (drain to zero, charge to rated voltage in 1/12 second, drain to zero and start ramp). The voltage vs. time was recorded, as well as the
charge dumped to ground during each self-healing event. "Unacceptable" self-healing was defined as: (1) one or more clearing charge dumps in excess of a trigger value; or (2) more than (n) self-healing events under the trigger value -- each measured over the course of a month. I do not recall the precise charge dump trigger value or the value of "n" -- I think "n" was 3, but many metallized film caps failed with "n" much higher than that -- sometimes 5-20 per day. A typical pattern was a series of self-healing events at lower and lower voltages, sometimes with a "reset" to a higher voltage followed by another series at lower and lower voltages. The "reset" event was usually a "charge dump in excess of trigger value" event.

I tested PE and PP metallized-film and film-and-foil caps, as well as Class 2 disk ceramics. The caps were all new stock from quality manufacturers, acquired through the primary supply chain. Values ranged from 0.005 to 0.22 uF. (I also tested some large film caps -- 5 to 100 uF -- and some more esoteric dielectrics -- but that is not pertinent to BA bypass caps.)

This was an extension of a project to characterize capacitors in a production environment where we needed to get failure rates over the equipment lifetime down very, very close to zero. We also had extremely limited space, so there was a lot of pressure to use metallized film caps. In the production test, a single self-healing event over the course of a month disqualified a capacitor. No metallized film cap ever passed that test. Best regards, Charles

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Date: Sun, 28 Apr 2013 07:48:08 -0700
From: Dan Merz <mdmerz@frontier.com>
Subject: Re: [R-390] Orange Drop Caps vs Film Polyester Axial

Hi, thanks for the detail. About what year was this kind of testing done?

From: "Charles P. Steinmetz" <charles_steinmetz@lavabit.com>
Subject: Re: [R-390] Orange Drop Caps vs Film Polyester Axial

>About what year was this kind of testing done?

Sporadically from the late '70s through the early '00s, as new candidates appeared.

Date: Sun, 28 Apr 2013 15:13:26 -0400
From: "quartz55" <quartz55@hughes.net>
Subject: [R-390] Caps

How about the Panasonic Polypropylene like these
http://www.mouser.com/ds/2/315/ABD0000CE47-63820.pdf
I don't see anything in there about self healing, plus they're a much better size and good price too. I put them in one of mine except for the filter caps.

Date: Sun, 28 Apr 2013 15:11:22 -0500
From: n4buq <n4buq@knology.net>
Subject: Re: [R-390] Caps

I may be wrong, but I think all metallized film caps are self-healing.
http://en.wikipedia.org/wiki/Types_of_capacitor
"Metallized film capacitors offer self-healing properties." That may or may not mean /all/ of them, though.

Date: Sun, 28 Apr 2013 16:26:34 -0400
From: "David C. Hallam" <dhallam@knology.net>
Subject: Re: [R-390] Caps

OK I give up! What magical properties do Sprague orange drop have?

Date: Sun, 28 Apr 2013 17:21:34 -0400
From: "Charles P. Steinmetz" <charles_steinmetz@lavabit.com>
Subject: Re: [R-390] Caps

No magic, they are just the most commonly available of the very few film-and-foil caps available today (i.e., NOT metallized film). For the reasons why film-and-foils are (IMO) the only plastic film caps to use in tube equipment, see the posts of the last week or two (and check the archives for previous rounds of this discussion).

Date: Sun, 28 Apr 2013 17:26:24 -0400
From: "David C. Hallam" <dhallam@knology.net>
Subject: Re: [R-390] Caps

I always used the Sprague film and foil axial capacitors until they were discontinued a year or so ago. Generally axial capacitors fit better into the space available as a replacement capacitor. The only reason I ever ordered a radial orange drop was that the particular value I needed was not available in the axial type.

Date: Sun, 28 Apr 2013 17:37:26 -0400
From: "Charles P. Steinmetz" <charles_steinmetz@lavabit.com>
Subject: Re: [R-390] Caps

Dave wrote:How about the Panasonic Polypropylene like these

They are metallized film (see upper left corner of the datasheet), and suffer from the same self-healing behavior that plagues all metallized film caps. If you get the full engineering information on them, Panasonic (like all manufacturers of metallized film caps) is very up-front about it. They just didn't put it on the abbreviated datasheet.

>I may be wrong, but I think all metallized film caps are self-healing.

Correct. At least, all commercially-available metallized film caps. In principle, if one used film as thick as is used in film-and-foil caps, it might go a long way toward mitigating the problem (there would still be the issue of the vapor deposition of the metallization, which is hard on the film). But nobody does, at
least not in their general capacitor lines.

Date: Sun, 28 Apr 2013 19:52:52 -0400 (EDT)
From: L L bahr <pulsarxp@embarqmail.com>
Subject: Re: [R-390] Caps

I think this reflector is turning out to be a "tom -foolery" group similar to those of the audio fools.

Date: Sun, 28 Apr 2013 17:14:15 -0700 (PDT)
From: Perry Sandeen <sandeenpa@yahoo.com>
Subject: [R-390] Shorting cap consequences

<snip> but in general there is no massive belch of smoke.....

I respectfully disagree with this generalization. There are numerous bypass caps to ground after the use of a dropping resistor in the R-390A and SP 600 that will joyfully smoke upon a bypass capacitor short.

Date: Sun, 28 Apr 2013 17:17:15 -0700 (PDT)
From: Perry Sandeen <sandeenpa@yahoo.com>
Subject: [R-390] Capacitor failure

<snip> The gotcha with B+ bypass caps is that you can lose a filter choke.....

This is why one makes the 3 fuse mod to a R 390A and adds an additional separate fuse to the SP 600 B+ circuit. See Andy Moorer?s SP 600 site or the SP 600 anthology for details. And the most likely cap to short is not a .01 bypass unit but an electrolytic. That is why at least on the R-388 and R-390A they used socketed filter caps for easy replacement. Also the high value of inductance is not necessary any more as one can use those sold for Dynaco replacements sold by Triode electronics and use modern multi-hundred filter caps instead. BTDTGTTS. (It takes 20 pounds out of a SP 600.)

Date: Sun, 28 Apr 2013 17:53:44 -0700 (PDT)
From: Perry Sandeen <sandeenpa@yahoo.com>
Subject: [R-390] Urban Legend Cap

Charles Steinmetz has commented extensively about problems with film foil caps. In his usage situation these may pose a problem. In group buys that I have made for the list over the last 9 or so years or so, I sold over 4,000 Vishay/Sprague 197LS.01 1KV 20% ceramic bypass caps for both R-390A and SP 600 radios. On another buy I sold 1,000 .01/600 volt film bypass caps. As the Vishay/Sprague price had risen dramatically, on the last buy I made for the group I bought 2,000 Murata DEB series .01 1KV -20 +80%. Let me assume for a moment that only 50% have been installed so that makes 3,500 caps. No one has ever told me that even one has failed. With that type of track record I am not going to stuff oversized and 8 time the price (in 1,000 pieces $1.22) caps in my equipment for bypass use.

And to add insult to injury for those who are dead-set on using them, according to the current Mouser online info, they are being discontinued. And AFAIK all the tubular bypass caps made up until the 1960's were all of foil construction. Correction welcomed.

Now for a bit of logic. IF only foil construction capacitors met current HV needs, many manufactures would be making them. Instead just the opposite is happening. They are all making deposited metal coated plastic types. So besides being cheaper and smaller they are accepted as reliable by the electronics industry for high voltages.

I don't care if people choose to use OD's for their radios. It their preference. They can use Leyden jars if so inclined.

What I'm opposed too is this urban legend that will not die is that OD's are necessary. (Egor! Get the garlic, cross?s and wooden stakes!) We have new people coming to the list seeking information and are then mis-informed. When one recaps a whole receiver, which is changing from desirable to mandatory as the sets get older, the economic difference

between the two is probably around $100.

I will wager USD $1,000.00 that no one on this list can prove that foil OD caps are measurably superior to the equivalent ceramic caps in bypass applications in BA receivers. Any takers?

Date: Sun, 28 Apr 2013 21:14:09 -0500
From: "Bill Hawkins" <bill@iaxs.net>
Subject: Re: [R-390] Urban Legend Cap

Well said, as usual. Still, it does no good to argue religious issues. One thing - Igor was young Dr. Frankenstein's assistant. After that, he began appearing everywhere, even Igorinas. Perhaps you were thinking of Eeyore.

Date: Sun, 28 Apr 2013 19:43:25 -0700 (PDT)
From: Wes Bolin <k5apl@yahoo.com>
Subject: Re: [R-390] Urban Legend Cap

I am a little confused after reading all these posts.?
Can someone clarify for me:
1.) The self-healing film capacitors only heal with HV transits?
2.) How many HV transits do bypass capacitors see in a radio over time?
3.) Do self-healing film capacitors have a shorter MTBF than other tyoes?
4.) Is it wise to (or not) to use a High Voltage rated film capacitor in lower voltage circuits (like 1 KV rated in 250 VDC circuit)....basically???? will it have longer MTBF from less voltage?

I just re-capped my SP600 using ceramic discs in the RF deck, but metal film bypass capacitors in the rest of the radio.? Do I need to swap out the metal film caps with ceramic discs (or metal foil, or???)?

Date: Sun, 28 Apr 2013 23:16:18 -0500
From: Cecil <chacuff@cableone.net>
Subject: Re: [R-390] Urban Legend Cap

> <snip> Vishay/Sprague 197LS.01 1KV 20% ceramic bypass caps <snip> .01/600 volt film bypass caps.<snip> Murata DEB series .01 1KV -20 +80%.....

There is no question...any and all of the above will work in the radios....I'm not sure that's ever been In question...

> No one has ever told me that even one has failed.....

These radios are 50+ years old...the question in my mind is what kind of

shape will the caps we install be in...say 30 years from now. Many wont care because they won't be around at that point...but someone will hopefully be enjoying them...and at that point in time, point to point wired components will probably be long gone. So an investment in decent quality parts today will prove its value in the years to come when replacement parts may not be available at all.

>they are accepted as reliable.....

Problem is the stuff they are building now days are designed for a useable life expectancy of about 7 years max..and much less in many cases. I can't tell you how many flat panel TVs and computer monitors I have repaired by replacing bad electrolytic caps....things that didn't use to fail for 20 years or more in equipment designed to be durable. That's not the quality of parts I want in my tube gear if I have a choice.

>....no-one on this list can prove that foil OD caps are measurably superior...

I've never seen that asserted... I think I have seen pretty universal agreement that, in bypass applications, ceramic disks are very acceptable and more economical than using OD caps or any film/foil caps in that application. I think it has also been pretty universally accepted that a better application for the film/foil caps would be for coupling...and if one chose to apply them in that manner, the OD would be considered the Cadillac of those type caps...but that there are other choices that one could make and and end up with a very acceptable restoration. A good example is the Hammarlund SP-600 that was factory built with all ceramic disks for bypass and coupling...now some 60 years old and generally not in need of those caps needing replacement. The only magic the Sprague Orange Drop has is that it is the last of the really high quality, over built film foil caps being made and as you say that may be coming to an end....and that's no Urban Legend

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Date: Mon, 29 Apr 2013 00:16:36 -0400 (EDT)
From: L L bahr <pulsarxp@embarqmail.com>
Subject: Re: [R-390] Urban Legend Cap

Hey Wes, Haven't the boyz told you yet ceramic discs will give you microphonics! That will be the next misinformation given. Haven't you heard, ceramics won't give you good tone either. Another good topic will be what type getters your tubes have in them or should you have black or gray plates in the valves! The way I look at it, if they are good enough for my beloved Hallicrafters S-38, they will be good enough for my R-390s.

Date: Mon, 29 Apr 2013 00:22:52 -0500

From: Cecil <chacuff@cableone.net>
Subject: Re: [R-390] Urban Legend Cap

I'm not sure what boyz you speak of Lee. Some of what you mention above is certainly relevant to vintage guitar amps and in that application is not totally hype...musicians will clear that up for you quickly. They don't apply the technology in the same way we do in tube radios. Can't remember the last time someone asked for smoother overdriven breakup in the push pull output stage of their SX-28A. I think you coined it..." know of what you speak". I would recap an S-38 from my junk box (if I had one..can't imagine that though)... something I would never do with one of my SP-600s or R-390s. Wes as far as the work you have done on your SP-600, don't sweat it. If its working well just enjoy using it...if you have a cap failure in the future replace it with a ceramic disk and enjoy it some more...those are easy to get to for the most part. I do SP-600s with all ceramic disks (1kv)...it was good enough for Hammarlund and the government, works for me. Anything you put in is better quality than the black beauties of death you took out. I'm fixing to start work on a Racal RA-17L and will replace all the Hunts paper caps with either ceramic disks or ODs. Won't have to revisit that work in my Sons lifetime....but that's a personal preference...certainly not the only way it could be done properly.

Date: Mon, 29 Apr 2013 02:21:45 -0400
From: "Charles P. Steinmetz" <charles_steinmetz@lavabit.com>
Subject: Re: [R-390] Urban Legend Cap

>..... self-healing film capacitors only heal with HV transits?.....

No, as I posted yesterday morning they heal just about any time, from imperfections and pinholes in the extremely thin and overstressed dielectric.

>..... shorter MTBF than other types?.....

Depends on what you mean by "failure" (the "F" in MTBF). The manufacturers of metallized film caps do not call a self-healing event a "failure." But as far as tube circuits go, they are failures that recur as often as 100 times a day. Note that one of the reasons the electronics industry doesn't care about self-healing is that today's high-voltage cap applications are not tube circuits. There are plenty of circuits where self-healing is not a big problem, but tube radios is not one of them. However, the tube device market is too small for any major manufacturer to care about. There are a few small manufacturers of film-and-foil caps that cater to the audiophile market, but their prices are insane and their production is so low that it's impossible to know if they are reliable. I

would not trust them.

>.....Do I need to swap out the metal film caps with ceramic discs.....

Hard call, when you have already put in the time to do it once. Personally, I'd go back and replace all of the bypass caps with ceramic disks, both for reliability and because SP-600s are notorious for IF and IF harmonic leakage problems and you want all the help you can get from your decoupling. That is what I ended up doing with my SP-600, which the previous owner had re-capped with all Orange Drops. (The very last revision of the SP-600 addressed the IF leakage problem -- but those radios also came from the factory with ceramic bypass caps, so you wouldn't be replacing them now. Very, very few of these "last generation" units were made.)

Date: Mon, 29 Apr 2013 03:52:45 -0400
From: "Charles P. Steinmetz" <charles_steinmetz@lavabit.com>
Subject: Re: [R-390] Capacitor failure

>..... the most likely cap to short is not a .01 bypass unit but an electrolytic.....

Definitely not true of the SP-600. The paper bypass caps have proven to be hundreds if not thousands of times more failure-prone than the electrolytics over these radios' lifetimes. Also, most choke failures are the result of long-term overheating from one or more leaky bypass caps, not a sudden current surge from a cap going shorted -- so a fuse that is large enough not to nuisance-blow on a properly-working radio may not give much if any protection.

Date: Mon, 29 Apr 2013 04:20:57 -0400
From: "Charles P. Steinmetz" <charles_steinmetz@lavabit.com>
Subject: Re: [R-390] Urban Legend Cap

>.....about problems with film foil caps.....

No, my comments have been about the problems with *metallized film* caps and how film-and-foil caps do not suffer from these problems.

>.....foil OD caps are measurably superior.....

I have repeatedly said that disk ceramics are superior to film caps -- including ODs -- for power supply bypass applications. So, I would always choose disk ceramics over any film cap for bypass applications, and have said exactly that many times on this list. Film caps are the caps of choice for signal coupling

applications, so there are usually a few places in a BA where they are necessary. And in those places, one should use film-and-foil caps rather than metallized film, for the reasons I have discussed.

Date: Mon, 29 Apr 2013 07:33:56 -0400
From: Bob Camp <ham@kb8tq.com>
Subject: Re: [R-390] Shorting cap consequences

The normal self healing event is a brief short to ground that quickly clears. It shorts (fails) and then un-shorts (heals). The sort of resistors and inductors running around in an R-390 are not going to burst into smoke from a very brief short. They die from heat and a short burst isn't going to heat them up much. You can indeed have a self healing event that does not even take the cap all the way to ground, they can clear that fast (very small mass, lots of energy).

A dead short to ground that does not clear - yes that will do something. A dead short to ground is a full blown capacitor failure. That makes it an MTBF issue. I have yet to see any part that is rated for an infinite MTBF. They all fail some way some time, more so in a hot boat anchor than sitting at room temp.

Date: Mon, 29 Apr 2013 10:20:43 -0400
From: "Todd, KA1KAQ" <ka1kaq@gmail.com>
Subject: Re: [R-390] Urban Legend Cap

A bit more to the OD story that newer members may not be aware of unless
they did an extensive search of the archives....

Audiophool nonsense aside (which seemed to come along after the R-390 usage anyhow), a decade or more ago we had a very extensive discussion on cap replacement on the list. Which type, which manufacturer, and why. At that
time a lot of list members were rebuilding their receivers. Aside from Orange Drops the next best 'favorite' if you will were the little yellow tubular ones which someone labeled "yellowjackets" at the time. There were a few others too, but they escape me now.

One big drawback to the ODs was the radial leads - a real PITA in tight situations. But there were two big pluses that canceled that out for most folks: high quality and made in the good ol' USA. I recall Chuck and I really beat the drum for Orange Drops then to support SBE. Our reasoning was and I'm sure still is - if you have a top notch product available from someone in your own country who is providing jobs and helping the economy, why wouldn't you want to support them to keep them around?

Most of us figured we'd have additional needs well beyond the R-390 series.

A little history on SBE, or SB Electronics. When Sprague went piggies-up and everything was split up, a couple local guys in Barre, VT (where Ods were manufactured) bought that sliver and restarted the biz. Can't recall who the S was, but the B was Perry Browning. I met him years ago at a Christmas party with my ex, nice fellow. They continued to produce ODs for (at that time) a number of customers, including AES in Tempe. Despite rumors to the opposite, they also made and labeled the ODs for Vishay, or at least that's what folks at the factory told me. One of the benefits of living locally and knowing a lot of people was having friends at SBE who kept me well-stocked with "aged" caps that were routinely removed from stock. Nothing wrong with them, just policy and I suspect a bit of make-work.

A few years back now, Perry got out of the business and it was bought out by a fellow named Ed Sawyer, a ham whose callsign escapes me. I think he moved to VT from AZ IIRC, and had a 7 Land call. He continued on with the business while branching out into other areas as the traditional cap markets began to dry up. One of the things they got into is the Power Ring cap business. These are essential for electric cars. Ed was active in the local club and always very generous about donating caps for sale at hamfests etc to benefit the club. I seem to recall that he's an avid contester too.

One of the things SBE offered was special run, or custom caps. A few years back I came to the list to see if anyone had interest in a bulk buy of a particular value, style, whatever. I was also working on getting some made up in axial form (which they could and did do, I have a box full). The response I got was 'why bother when you can get xyz from Mouser, Digi-key?" or such. So that was that, a lesson well-learned.

Last year I was informed by a friend there that ODs were no longer being made in Barre VT but had been moved to China. Think I mentioned it here. I guess it was inevitable considering the lessening demand for older-style components. Surface mount and smaller from here on out. Interestingly, the manufacturing equipment for making custom runs is or was still in place. (They could make them in other colors, BTW).

As to the fate of the Orange Drop line that so many think Vishay owned/owns
but were always owned and manufactured by SBE? Is it, as Perry's aforementioned ad claims, no longer made? Find out from the horse's mouth:

Key Milestones *2012*
 - SBE sells its Orange Drop? product line to Cornell Dubilier Electronics, Inc.

Maybe CDE just bought the line to fold it? Dunno.
Plenty of other good info on their homepage, as always:
http://www.sbelectronics.com/

Hopefully this clears up some of the mystery around the R-390/Orange Drop
connection. No magic or hype involved, just a desire to support a local(US) business that made a superior product we needed - even if it cost a few cents more. When you strip away the layers of misunderstanding and misinformation from the intervening years and those who came along later, that's all you'll find. And for those lucky enough to have a stash - they're still damned good caps.

Date: Mon, 29 Apr 2013 12:59:54 -0400
From: "quartz55" <quartz55@hughes.net>
Subject: [R-390] Caps

So what are people using on the AF board? The OD will not fit on the board, or rather you can't mount the module on the chassis. I found some TDK X7R MLCC that may be appropriate for the bypass caps i.e. FK22X7R2J104K, digikey has them for $1.71. Mouser has the rest in .01, .033 and I think .047. The size is right. What about using the MLCC X7R on the audio board?

Date: Mon, 29 Apr 2013 10:11:35 -0700
From: "Craig Heaton" <hamfish@efn.org>
Subject: Re: [R-390] Caps

OD 715P's will fit on the AF board! Got several R-390/A's with these installed. Used a recommended 0.022uF value (better audio?), bent those terrible radial leads with my bare hands & tilted them over so they board would fit. C604 & C605. Used a dry tantalum Mouser part # 74-150D50V10 for the cap that rots, C609.

Date: Mon, 29 Apr 2013 13:28:22 -0400
From: rbethman <rbethman@comcast.net>
Subject: Re: [R-390] Caps

This has gone on FAR too long!
I purchased a large bag from Perry Sandeen.
I also purchased complete replacement kits from Dave Bingham.

These and others I purchased from Arcadia Electronics here in Virginia HAVE BEEN metalized film capacitors! They have been rated at 600V or 630V.
I've used these in R-390As, SP-600s, and misc. Hallicrafters pieces. (Apache, Mohawk, and DX-60.) *IF* there has been "self healing" taking place, I *certainly* have not had ANY indication! All of the above ARE tube based. Yes, Hollow State! I have had ONE failure in one R-390A. It was the frickin' audio tube that shorted and took out a 2W carbon resistor! Absolutely nothing else!

This has become utter insanity! I've had WORSE issues with plate blocking caps! Those that are some brown molded *crap*, not the red resin ones, can't even keep their value sitting on the shelf! Every single Brown Beauty of Death has been removed from the '51 Contract Collins! All replaces with the aforementioned metalized film types.

Date: Mon, 29 Apr 2013 12:54:49 -0500
From: Cecil <chacuff@cableone.net>
Subject: Re: [R-390] Caps

The kits I purchased from Dave were film foil orange drops.

Date: Mon, 29 Apr 2013 14:01:07 -0400
From: rbethman <rbethman@comcast.net>
Subject: Re: [R-390] Caps

The kits I got from Dave weren't the bright ODs. They were more like brown or dirty orange. None were like the ODs that the black beauties in my Northern Radio were replaced with. Those are very bright Orange Drops. You can spot them across the room!

Date: Mon, 29 Apr 2013 14:12:01 -0400 (EDT)
From: Barry <n4buq@knology.net>
Subject: Re: [R-390] Caps

Could a healing event (or series of events) take out a mechanical filter?

Date: Mon, 29 Apr 2013 14:17:01 -0400
From: rbethman <rbethman@comcast.net>
Subject: Re: [R-390] Caps

That is the ONE place that I use a ceramic 1KV disk!

Date: Mon, 29 Apr 2013 11:22:20 -0700 (PDT)
From: wli <wli98122@yahoo.com>
Subject: Re: [R-390] Caps

Agree with Cecil completely and could not have put it more succinctly! Whatever, it just makes sense to replace with the best quality that is available to us... makes no sense to sacrifice performance or durability. W. Li

---

Date: Mon, 29 Apr 2013 14:54:36 -0400
From: "Charles P. Steinmetz" <charles_steinmetz@lavabit.com>
Subject: Re: [R-390] Caps

>.....take out a mechanical filter?.....

Yes, definitely. And note that C553 is a signal-coupling cap, so it is one of the locations where a disk ceramic is contraindicated, due to leakage and distortion (a ceramic in this location causes enough distortion to change the IF harmonic output measurably).

Date: Mon, 29 Apr 2013 15:36:38 -0400
From: "Charles P. Steinmetz" <charles_steinmetz@lavabit.com>
Subject: Re: [R-390] Urban Legend Cap

Excellent summary, thanks for the reminder. I had thought that Vishay acquired an interest in SBE, leading to an exclusive distribution deal, but perhaps that was not so. Lately, I see distributors stocking ODs from both SBE and CDE (Cornell Dubilier), in addition to Vishay/Sprague:

<http://www.sbelectronics.com/2012/10/sbe-announces-the-sale-of-the-orange-drop-product-line-to-cornell-dubilier-cde/>

<http://www.prweb.com/releases/2012/10/prweb9965785.htm>
<http://www.cde.com/catalogs/225p.pdf>
<http://www.cde.com/catalogs/715p.pdf>

<http://www.sbelectronics.com/wp-content/uploads/2012/06/716p.pdf>

<http://www.sbelectronics.com/wp-content/uploads/2012/06/225p.pdf>

Very unlikely that CDE would have paid good money for the OD line just to discontinue it.

Date: Mon, 29 Apr 2013 15:59:35 -0400
From: Bob Young <bobyoung53@hotmail.com>
Subject: Re: [R-390] Caps

Just wanted everyone on the list to know that this thread has been appreciated by at least one member. I know probably a few of the list

oldtimers may be getting antsy with it but I've learned a lot in the past few days.

Date: Mon, 29 Apr 2013 16:20:32 -0400
From: "quartz55" <quartz55@hughes.net>
Subject: [R-390] Caps

Even the 400V 715P won't fit in my AF unit. I only have 12mm from the board to the chassis and they're 12.7mm dia.

Date: Mon, 29 Apr 2013 13:22:12 -0700 (PDT)
From: Joe Connor <joeconnor53@yahoo.com>
Subject: Re: [R-390] Caps

I like it, too. It's always fun to listen to knowledgeable and passionate people discussing a topic near and dear to their hearts. It's a great way to learn.

Date: Mon, 29 Apr 2013 13:29:27 -0700 (PDT)
From: Steve Toth <stoth47@yahoo.com>
Subject: Re: [R-390] Caps

Ditto - some of us were not fortunate enough to have R390A's 10 or more years ago, and learning from the accumulated knowledge and experience of the members of the board is great.

Date: Mon, 29 Apr 2013 13:45:40 -0700
From: David Wise <David_Wise@Phoenix.com>
Subject: Re: [R-390] Caps

I'm having trouble with your statement below, Charles. Here's what I believe:

1. There's no potential for distortion; the reactance is only 35 ohms.
2. Ceramic leakage is innocuously low.

I don't know about their reliability. I suppose it depends, same as for film/foil.
Really, I don't care what the dielectric is, or the packaging, as long as

(a) it WON'T EVER HURT my filters!
(b) it will fit,
(c) it doesn't cost a week's wages, and
(d) I can get them.

Give us a few makes/models, and we'll call it a day.

Date: Mon, 29 Apr 2013 17:15:05 -0400 (EDT)
From: Barry <n4buq@knology.net>
Subject: Re: [R-390] Caps

Unfortunately, several years ago, I recapped an R390A with Illinois Capacitor caps from JustRadios. Now I regret that as I'm pretty sure I used one for C553. I wish I remember who I sold it to... I did that as a result of having done one with ODs and, while it wasn't all that terribly hard to do, I thought I'd give the axial leaded style a try. I was going on the thought that "pretty much any modern capacitor is better than what was used when the radios were new". Guess that was not necessarily true. :(

Date: Mon, 29 Apr 2013 18:10:26 -0400
From: "quartz55" <quartz55@hughes.net>
Subject: [R-390] Caps

Yeah, I'd like to see what others have used if not all ODs, especially with the ten IF 0.1uF as ceramic disk, nearly all of them are bypass caps. Only C531, audio coupling and C538 (filament bypass, which could even be a 50V cap) are not bypass caps. It's not easy to find a 0.1uF high voltage in even a ceramic at a decent price.

The five .033uF in the IF are all bypass.

The two IF .01uF are both coupling caps. Does anyone use a larger value for C549, the audio coupling and of course the V501 plate to filter C553 is fine as a .01 at 455KHz, no problem using an OD there.

All the caps in the AF section are audio coupling except the electrolytics. I've already replaced mine with some metalized ones, but it would be easy enough to fix if I could find one that will fit on the board and not hit the chassis.

I did one IF in all OD, I got them in, but it's really not pleasant to look at, although I did a bang up job. I'm just trying to get the price down a bit and mostly make it neater looking and easier to work on. I'm not that concerned about price, but it would be nice not to spend $2/cap.

I'm also going to replace the 5000pf bypass caps in one of my IF's because something else is wrong and I can't find it. I'm pretty sure I'm going to use X7R for those. I'm thinking the MLCC look like a good small option for those unless someone thinks not for a good reason. I won't whine.

Date: Mon, 29 Apr 2013 18:23:20 -0400
From: Bob Camp <ham@kb8tq.com>

Subject: Re: [R-390] Caps

How safe do you feel with a 630 V part?
Digikey has 0.1 uf X7R's for a buck apiece.

Date: Mon, 29 Apr 2013 18:32:46 -0400
From: "Charles P. Steinmetz" <charles_steinmetz@lavabit.com>
Subject: Re: [R-390] SP-600 IF and IF harmonic leakage [WAS: Urban...]

>I will go back and re-do the IF bypass capacitors with ceramics.
>I like to solder.

As long as you are going back in there, it is worth your while to look at the 455 kHz IF output follower circuit, which is what causes the largest part of the IF and IF harmonic leakage. Here are some extracts of previous posts from the list archives (February 2008) that explain the problem and what to do about it (not
my posts, but I have found the same thing):

>Some versions [of the SP-600] have IF output amplifiers that run the
>tube into severe nonlinearity, which generates bad spurious
>responses at 910 kHz and other harmonics of 455 kHz.
>
>* * * Put a scope on the 455 IF output [when you have a nice
>strong CW signal tuned in] -- if it is a nice [clean] sine wave, it
>doesn't need fixing.

Otherwise (if it looks distorted), here's the fix:

>on units that have the problem, it isn't in the IF itself, it is in
>the buffer stage that drives the 455 kHz output jack on the rear
>panel. The harmonics of the 455 kHz IF signal that are generated in
>the overloaded buffer amp are then received by the radio as spurious
signals.
>
>There were (at least) three IF output schemes used by
>Hammarlund. The older ones give very high output (10V or more p-p)
>with lots of harmonics (clipping on the negative swing), and the
>newest one gives a very clean 1 or 2V p-p.
>
>In the oldest version the buffer ampifier -- a cathode follower
>(V16a) -- is fed straight (through C145) from the tied plates of the
>IF Driver (V11) and BFO Buffer (V12).
>
>The newest version uses an additional connection inside T5 to feed
>the follower (through C145 and some shielded cable) from the top of

>the secondary. This has two advantages -- it reduces the feed level
>by the gain of the IF Driver (V11), and it picks off the IF output
>feed before the BFO injection. The newest version also uses a
>tapped coil (L53) as an autoformer on the output (the cathode of
>V16a feeds the top of L53 through C147, and the IF output jack
>connects to a tap a ways down on L53).
>
>The middle version has the old-style feed plus L53. I believe this
>is the most comon configuration.
>
>If one has an old-style or middle-style unit I highly recommend
>changing it, because the distortion in the follower due to the high
>signal level radiates harmonics of 455 and causes spurious signals.
>
>To change it, one can go into T5 and add the connection for
>C145. In this case (assuming one already has L53, or adds it) you
>end up with exactly what Hammarlund built later. Or, you can take
>the feed without going into T5 by putting C145 on the junction of
>R55/R56 (the output of T5). I prefer the second method, because it
>comes out at a bit lower level and does not unbalance the load on
>the secondary of T5. In either case you need to feed the signal
>from T5/V11 through shielded cable, grounded at both ends, to the
>grid of the follower (V16a). C145 goes at the T5/V11 end of the
>coax to minimize the capacitive loading on T5 (the capacitance of
>the shielded cable ends up in series with C145). You don't need to
>try to chase down an appropriate coil to use for L53 -- the follower
>can just drive the IF output directly. If you want, you can use a
>resistive voltage divider in place of L53 to lower the signal level some
more.
>
>Alternatively, if you don't use the 455 kHz output, you can reduce
>spurious responses even further by disconnecting C145 from the tied
>plates of V11 and V12 and connecting it to ground instead.

From the same post, information regarding two caps you may not have replaced, which can benefit from being replaced with ODs:

>There are only two audio coupling caps -- C143 & C149, both 5100 pF
>mica. You can change them to .005 or .01 uF Orange Drops if you
>want, and will realize some improvement in the audio.

Datete: Mon, 29 Apr 2013 19:03:17 -0400
From: "quartz55" <quartz55@hughes.net>
Subject: [R-390] Caps

Thanks Bob, I think I've found the RDER72J104K8K1C11B at digikey.

Looks like a good series all the way from 5000pf up for bypass in X7R. Nice and small and decent price, less than $1 each. I can live with 630V.

Date: Mon, 29 Apr 2013 16:22:47 -0700
From: Gordon <gordon@n6wk.com>
Subject: Re: [R-390] Caps

I also am learning a lot about the different types of caps. I had no idea it would take off like this when I first asked the question. The information being shared is outstanding!

Today I re-assembled the gear train and set the band switch and all the cams as well as the 10 stop controls. Everything lines up just as it should and NO extra parts on the bench..LOL Wow does it turn easy and smooth now. Almost silky smooth !! The only thing I don't care for is how noisy the Veeder Root counter is when you turn the KC knob very fast. The noise seems to be coming from inside the counter. It's a whirring noise when spinning fast. Is this normal?

Date: Mon, 29 Apr 2013 19:28:46 -0400
From: "Charles P. Steinmetz" <charles_steinmetz@lavabit.com>
Subject: Re: [R-390] Caps

>1. There's no potential for distortion; the reactance is only 35 ohms.
>2. Ceramic leakage is innocuously low.

You are welcome to your belief -- but is it a belief based on testing? Test for yourself. There is much more to the complex impedance of a ceramic cap than its reactance, including a very nonlinear real part. It doesn't take much distortion to create significant spurious responses and radiated QRM. Don't forget that the distortion and leakage of ceramic caps are worse at elevated temperatures.

>Give us a few makes/models, and we'll call it a day.

The only caps I can recommend for C553 are film-and-foil ODs of the appropriate value (0.01 uF) and a voltage rating of 600 Vdc or above. Series 225P, 715P, or PS will work (the Series is the first 3 digits of the part number, or the second and third character in the case of Series PS):

225P10396X 600 Vdc
715P10396K 600 Vdc
716P10396J 600 Vdc
6PSS10 600 Vdc

I do not see any need to use caps rated at more than 600 Vdc. Series 716P

and 418P will also work, but they are special order items. Some of the higher voltage rated 715P caps are also special order items. Sometimes distributors have specials in stock because a large customer needed them, but they are generally rare.

Date: Mon, 29 Apr 2013 20:11:17 -0400
From: "Charles P. Steinmetz" <charles_steinmetz@lavabit.com>
Subject: Re: [R-390] Caps

>Yeah, I'd like to see what others have used if not all ODs, <snip>

Ceramic is best. You can be a bit flexible with the values. Ceramics are enough better at bypassing than the original paper caps that you can probably even use 0.01 disk ceramics and get performance better than the radios had with the original 0.1 uF paper caps. I bought a lifetime supply of epoxy-coated, 1 kV, 0.02 uF X7R disk ceramics long ago (when they were less than $0.02 each in quantity) and use them for all bypass applications. If I were replacing a 0.1 uF bypass cap, I'd use from 3 to 5 of the 0.02 uF disk ceramics in parallel.

>Only C531, <snip> and C538 <snip>.....

I'd use 600v ODs for all audio coupling and a 0.05-0.22 uF ceramic for all heater bypass caps (though I'd use a 200v rated part, not 50).

>Does anyone use a larger value for C549, the audio coupling.....

I know some do, but the audio of a 390A is so lo-fi that I don't believe it helps. It extends the LF response to the point that you are pushing the poor audio transformers further and further into their LF intermodulation region if the source has any LF content (luckily, most don't, but in that case you don't need better LF performance, do you?). Overall, not a benefit, IMO. If you want
better audio, take a line-level feed from the diode load terminal and run it through the electronics of your choice. THAT's an improvement.

>I'm also going to replace the 5000pf bypass caps in one of my IF's
>because something else is wrong and I can't find it. I'm pretty
>sure I'm going to use X7R for those.

I'd use the same 0.01 uF (= 10,000pF) or 0.02 uF (= 20,000pF) ceramics you use for bypass elsewhere. The SRF of current disk ceramics is much higher than the original paper caps, and worries about the SRF were the only reason the designers used smaller caps there, so there is no reason to go down in capacitance if you use disk ceramics.

Date: Mon, 29 Apr 2013 21:06:09 -0400 (EDT)
From: Barry <n4buq@knology.net>
Subject: Re: [R-390] Caps

The list does tend to light up at times. Caps are one good way to ignite a conversation here. Paint colors, lettering techniques, lubricants, black ukumpucky, and kielbasa drippings are all good ones too. You'll enjoy the group.

Date: Mon, 29 Apr 2013 21:26:24 -0400
From: "quartz55" <quartz55@hughes.net>
Subject: [R-390] Caps
Message-ID: <C08A48F401924C2382F478636CA7CCF0@DAVE>
Content-Type: text/plain; charset="Windows-1252"

Thanks Charles, I'll take that as a place to start on the next IF and see if there is any real difference in either. Be a good check. But I'm sure the tubes will make more effect than the caps.

Date: Mon, 29 Apr 2013 23:06:49 -0400
From: "Charles P. Steinmetz" <charles_steinmetz@lavabit.com>
Subject: Re: [R-390] SP-600 IF and IF harmonic leakage [WAS: Urban...]

>Here are some extracts of previous posts.....

I dug up schematics of the three versions of the SP-600 IF output, highlighted the signal paths to make the differences easier to spot, and added the information on how to tell if an SP-600 needs to be modified and, if so, what to do. If you have an SP-600 and would like a copy, send me an e-mail OFFLIST. (Repeat -- OFFLIST.)

Date: Mon, 29 Apr 2013 20:59:14 -0700 (PDT)
From: "Drew P." <drewrailleur807@yahoo.com>
Subject: Re: [R-390] Caps

Given Charles' scathing indictment of metalized film capacitors in higher voltage applications, perhaps these could be relegated to service only in low voltage applications in our beloved R-390x. We could use them for cathode bypass and heater bypass. These are mostly 0.1 uF and the compactness of metalized film would most welcome.

We could likely use .01 uF or .02 uF disk ceramics in place of the .033 paper caps. I don't think that there was any magic in the .033 uF value, that is, unless, the designers were thinking of series resonance at 455 kHz to make for a more effective bypass. In the case of series resonance, we'll never hit upon it by simply replacing the cap with another .033 uF as

resonance would be partially determined by the cap's internal inductance, and what are the odds of some other cap having the same inductance (a non-specified parameter) as a Black Beauty. So just toss in some disks having a suitably low reactance, live long, and prosper.

Want cheaper ceramic disk bypass caps to replace the .033 uF? How about Z5U dielectric, and use .022 instead of .01 to soak up the voltage and temperature coefficients.

Orange drops? C-553, most definitely. Also for audio coupling, because the audiophools like them too. Need at least a token Orange Drop presence in our R-390x to keep the religion alive. Kinda like people who go to church only on Christmas and Easter.

Date: Tue, 30 Apr 2013 10:21:40 -0400
From: "David C. Hallam" <dhallam@knology.net>
Subject: [R-390] Axial Caps

Are there any suppliers who still manufacture axial film/foil capacitors that sell at a reasonable price, i.e., less than several dollars apiece? If I am refurbishing a single piece of my gear, that price maybe OK. But, if I have multiple pieces to repair/refurbish that's a little steep.

Date: Tue, 30 Apr 2013 11:40:56 -0400
From: rbethman <rbethman@comcast.net>
Subject: [R-390] Caps

A link provided by Chuck R.,
<http://www.justradios.com/DMEcapacitors.html>

These ARE 630V ODs. They ARE metalized film!
All ODs are NOT foil and film.
Folks are not seeing the whole picture.

Date: Tue, 30 Apr 2013 08:50:03 -0700
From: Gordon <gordon@n6wk.com>
Subject: Re: [R-390] Caps

I thought metalized film were what everyone is saying NOT to use ?

Date: Tue, 30 Apr 2013 11:56:49 -0400
From: rbethman <rbethman@comcast.net>
Subject: Re: [R-390] Caps

That is what I am *trying* to point out! Not all ODs ARE the type that Charles is saying to use. Indeed, "some" ARE the metalized film. You really

have to dig through EVERYTHING! Hunt with care and caution!

Date: Tue, 30 Apr 2013 13:41:30 -0400
From: "quartz55" <quartz55@hughes.net>
Subject: [R-390] Caps

Notice the Justradios orange caps are 'Orange Dips', not 'Orange Drops'. They freely advertize they are metalized film. I wonder if they have any complaints? Probably not.

Date: Tue, 30 Apr 2013 13:52:41 -0400
From: rbethman <rbethman@comcast.net>
Subject: Re: [R-390] Caps

There "may" be an issue over the "TradeMark" *Orange Drops* being used by another organization. Or perhaps they simply use that term since ODs are "dipped" in epoxy during the manufacturing process.

Date: Tue, 30 Apr 2013 14:01:06 -0400
From: "Charles P. Steinmetz" <charles_steinmetz@lavabit.com>
Subject: Re: [R-390] Caps

>I thought Metalized film were what everyone is saying NOT to use ?

Correct. The caps at the link are NOT ODs. They are lookalike "Orange Dip" capacitors apparently meant to trade on the reputation of ODs, and they are metallized film. They are not made by SBE, but by ETR, a company based in Taiwan with facilities in Shanghai, Hong Kong, Singapore, and India, in business only since 1994. The real OD line, formerly made by Sprague, then SBE, and now owned by CDE, has over 20 Series of capacitors, some of which are film-and-foil, some metallized film, and some hybrid. That is why I, Tisha, and others have taken pains to point out the OD Series that are film-and-foil and suitable for BA use. From a previous post:

>The only caps I can recommend for C553 are film-and-foil ODs of the
>appropriate value (0.01 uF) and a voltage rating of 600 Vdc or
>above. Series 225P, 715P, or PS will work (the Series is the first
>3 digits of the part number, or the second and third character in
>the case of Series PS):
>
>225P10396X 600 Vdc
>715P10396K 600 Vdc
>716P10396J 600 Vdc
>6PSS10 600 Vdc
>

>Series 716P and 418P will also work, but they are special order items.

Date: Tue, 30 Apr 2013 14:17:15 -0400
From: "Charles P. Steinmetz" <charles_steinmetz@lavabit.com>
Subject: Re: [R-390] Axial Caps

>....still manufacture axial film/foil.....

Not that I am aware of. CDE would probably be happy to make some axial-lead ODs, but you would have to be willing to buy quite a lot of them to justify a run.
If you use 1kV disk ceramics to replace all bypass caps, you will find that most BAs need only 2-5 film-and-foil caps in coupling applications -- this takes some of the sting out of the price. For these few, just get over the "I think using radial caps is ugly" thing, buy some Teflon spaghetti tubing, and bend the leads of ODs to suit the installation.

Date: Tue, 30 Apr 2013 15:21:04 -0400
From: "quartz55" <quartz55@hughes.net>
Subject: [R-390] Caps

I think Justradios uses 'Dips' to avoid calling them by a trade marked name, but it can be misleading.

That said, I ordered some MLCC caps today. RDER72J104K8K1C11B for the .1uF 630V, RDER72J103K2K1C11B for the .01uF 630V, and FK26X7R2J333K for the .033uF 630V. I decided to go pretty much with what value was in the original circuit. Although if I replace any of the 5000pf, I may just use the .01uF as Charles recommends. I was sent some information about the MLCC caps, they are apparently surface mounts with a lead attached and coated. So it looks like one must be very careful when bending the leads and soldering them in place to not stress the joint nor to place too much heat (250F max) on the wire to cap joint. Another issue is the change in value with applied voltage, but looking at the charts, if we stay within 50% of max voltage, the change is less than 2%, so I'm not worried about that. I may make a small fixture to heat sink and hold the leads in place while soldering. Once in place they should be good, they should probably not be disturbed after installation. I got more than enough for one radio and they only cost me about $25 including shipping from D-K. The few ODs needed otherwise only adds up to a few bucks, so this should be a reasonable price to re-cap, plus it looks like it should open up a lot of space in the IF deck.

I'm still looking for some .01 to .047uF for the AF deck. The OD 715P 400V .047uF ones I looked at are still too large diameter to fit on my board, unless someone has a number that will work, I'd appreciate it. It

looks like the .01uF 400V will fit, they're only 9.5mm dia. I'll probably be using an external audio amp off the diode load, so it may be moot, but I might as well fix it.

I just went through what I think the voltages on the AF caps may be and this is what I get, C601 - 12VDC, C602 - 75VDC, C604 - 12VDC, C605 - 50VDC, C607 - 12VDC, C608 - 55VDC, C609 - 3VDC, so it appears to me that a 200V rating on any of those caps would be plenty, which would make it much easier to find an OD cap to fit on the board and not hit the chassis. Correct me if I'm wrong or re-inventing things.

But I still need to finish the filters, I need to clean out my 8 and 16K, the 2 and 4 are ready for installation. I may have an extra 4K filter if it works when I get it back together. I still have another 4K that is the older style shiny case to do, but they are going to come after the 8 and 16K ones so I can finish up one of my IF modules. <snip>

Date: Tue, 30 Apr 2013 13:17:22 -0700 (PDT)
From: Garry Stoklas <jergar@sbcglobal.net>
Subject: [R-390] film/foil Capacitors

I just did a bit of research on film/foil capacitors and have found there is still at least one US manufacturer (Kemet A72 series)?of polypropylene film/foil axial lead capacitors. Unfortunately they are not a stock item, so would have to be ordered and have minimum order quantities. I'm getting a quote for the 0.1 uf
and .033 uf in 630VDC 10% and the .01uf in 400 VDC 10% (they don't show .01uf available in 630 VDC). They won't be cheap with the 0.1 uf having a minimum order of 860 pieces @ $2.59 each and the .01 uf with a minimum order of 1990 pieces @$1.56 each. They didn't have a price for the .033 uf and will email when they have it. Once I have the prices, if there are enough people interested, I would be willing to handle the transaction. Any other values the group thinks would be worthwhile considering?

Date: Tue, 30 Apr 2013 16:20:32 -0500
From: Raymond Cote <bluegrassdakine@hotmail.com>
Subject: Re: [R-390] Caps

This lack of understanding on caps is why this is such a long thread. The more I(we) read the more confusing it is. We all need a chart with specs written out in rows and columns. I have been looking for one. Maybe it had already been done by the cap manufacturers. I have re-read most of the posts and it is slow to sink in.

Date: Tue, 30 Apr 2013 15:18:06 -0700

From: David Wise <David_Wise@Phoenix.com>
Subject: Re: [R-390] Caps

I did a bit of shopping at Mouser, and found the following film/foil C553 candidates:

Wima FKP1 (five voltages, $1.13 at 1kV to $2.84 at 6kV)
CDE DMT ($1.64, 630V)
CDE WMF (axial leads! $2.14, 630V)
Vishay/Sprague or CDE 715P (three voltages, $1.85 at 600V to $4.45 at 1.6kV)

Wima is the cheapest and most abundant. Are they reliable?

The following are hybrid metalized/foil and therefore contraindicated:

CDE DPPM
CDE 942C (axial)
Wima FKP4

Date: Tue, 30 Apr 2013 19:28:33 -0400
From: "Charles P. Steinmetz" <charles_steinmetz@lavabit.com>
Subject: Re: [R-390] Caps

>Wima is the cheapest and most abundant. Are they reliable?

Wima is a very reputable manufacturer. However, the FKP1 is a very specialized snubber cap, not really suitable for other uses. Besides that, it is a hybrid metalized/foil. Note that the datasheet heading specifically mentions self-healing ("Double-Sided Metallization and Self-Healing Internal Series Connection").

The Wima FKP 3 polypropylene film/foil caps are outstanding capacitors, but available only in the familiar Wima "box" form factor with short (PC mount) leads. Nobody stocks them in the US in any depth. Mouser does not stock them, but will quote.

>CDE DMT ($1.64, 630V)
        The CDE DMTs are similar to 225P ODs.
>CDE WMF (axial leads! $2.14, 630V)
        I thought these were discontinued, but I may be mistaken. Mouser has some stock. The epoxied ends are not as environmentally rugged as a dipped cap, but that shouldn't matter for BA purposes.

Date: Wed, 1 May 2013 00:59:42 -0400

From: "KR4HV" <kr4hv@numail.org>
Subject: Re: [R-390] Caps

Doesn't the 716P have a different form factor? Maybe a little flatter?

Date: Wed, 1 May 2013 08:56:58 -0400 (EDT)
From: Barry <n4buq@knology.net>
Subject: Re: [R-390] Caps

>.....716P have a different form factor.....

IIRC, that was the form factor that will fit under the audio deck.

Date: Wed, 1 May 2013 09:28:49 -0700
From: David Wise <David_Wise@Phoenix.com>
Subject: Re: [R-390] Caps

Don't let FKP1's metallization put you off. The construction is foil...film... floating electrode... film...foil... etc. The floating electrode is metalized, but that bit of film is not acting as dielectric; it's just a cheaper way to make a floating electrode. There is non-metalized film to either side of it. This is not like the hybrids, where metalized film is sometimes the dielectric. Given the construction diagram, I can't see why they call FKP1 self-healing - it's a film-foil cap.

Date: Wed, 01 May 2013 21:26:11 -0400
From: "Charles P. Steinmetz" <charles_steinmetz@lavabit.com>
Subject: Re: [R-390] Caps

I'm inclined to take Wima's word for it if they say the FKP 1 is self-healing. In any case, the FKP 1 is still a specialized snubber, not designed as a general-purpose capacitor. Both the FKP 1 and FKP 3 (Wima's general-purpose film/foil capacitor) are packaged in the Wima "box" and are usually found with short (PC mount) leads, although the FKP 1 is sometimes found with longer (but still only ~ 1/2") leads. Both are thus poor candidates for use in point-to-point wired radios.

Date: Wed, 1 May 2013 22:25:22 -0400
From: sam letzring <sletz@msn.com>
Subject: Re: [R-390] Caps

CDE still makes 3 versions of axial-lead film/foil capacitors. Series WMC, WMF and WPP. I have been using a NOS supply of these for years on my boatanchor refurb projects. Just don't like the way the radial OD's and others look under the chassis. They are probably easily available from CDE distributors. I'm sure they would work with someone to make a

supply available to us fanatics!

Date: Wed, 01 May 2013 23:43:38 -0400
From: "Charles P. Steinmetz" <charles_steinmetz@lavabit.com>
Subject: Re: [R-390] Caps

>CDE still makes 3 versions of axial-lead film/foil capacitors. .....

400 Vdc is the highest rating available in the WMC line, due to the thinner dielectric used to miniaturize them (and note that 0.001 uF is the only value Mouser stocks). Although they are cataloged, I have not seen WPPs above 400 V stocked by anybody for years (decades?), and even the lower voltage ones are very scarce. If you can find some 600/630 V WPPs, they should work fine.

Some might ask why I think 600 V caps are necessary. I assume (i) that the entire power supply voltage of a radio could appear across a cap under failure conditions, and (ii) that unforeseen faults (or even foreseen events, like the turn-on surge in radios with solid-state rectifiers) could cause the actual power supply voltage to exceed the nominal value. In the (unlikely) event that both were to happen simultaneously, a 400 V rating is marginal for most BAs. Thus, my recommendation to use 600 V capacitors in BAs.

Date: Thu, 02 May 2013 08:05:29 -0400
From: "David C. Hallam" <dhallam@knology.net>
Subject: Re: [R-390] Caps

Check the current price on these capacitors. You will find the price is several dollars each. Maybe if you are doing a one off for yourself or someone with deep pockets and really doesn't like the looks of orange drops, otherwise just too much.

Date: Thu, 2 May 2013 11:26:38 -0700
From: David Wise <David_Wise@Phoenix.com>
Subject: Re: [R-390] Caps

I'll ask them for clarification. The Scottish in me won't let a bargain go that easily :) (I left out FKP3 because Mouser doesn't stock them. Pity.)

Date: Thu, 2 May 2013 11:43:46 -0700
From: David Wise <David_Wise@Phoenix.com>
Subject: Re: [R-390] Caps

I researched caps only for replacing C553. One per radio. For the others, self-heals are non-fatal so metalized film is okay. Hmm - C511 bypasses

the B+ on C553. A short there would hit the filter with a good-sized transient. But it's a 1kV ceramic. What's the word here? Are these ceramics more or less reliable than film/foil?

Date: Thu, 2 May 2013 14:08:06 -0700 (PDT)
From: Norman Ryan <nnryann@yahoo.com>
Subject: Re: [R-390] Caps

Strictly film/foil for C553.
Don't stint here.
0.01uF@600/630V Orange Drop is your best bet.

Date: Thu, 02 May 2013 17:28:35 -0400
From: rbethman <rbethman@comcast.net>
Subject: Re: [R-390] Caps

Both C511 and C553 could easily be disk ceramic caps.

Date: Thu, 2 May 2013 17:44:16 -0400
From: "Don Heywood" <wc4g@knology.net>
Subject: Re: [R-390] Caps

Yes, and it could also be two #16 insulated wires twisted into a half inch pigtail sometimes called a "gimmick". I have had it with the cap thread and the "king on the mountain game"

Date: Thu, 2 May 2013 17:52:51 -0400
From: Bob Camp <ham@kb8tq.com>
Subject: Re: [R-390] Caps

If you look at line transient data, a 2X line voltage burp is a fairly common / wide pulse event. An 8X burp is a much less likely / narrower spike sort of thing. The 2X ones are common enough / high enough energy that a transient suppressor that triggers below that is headed for an early death. PC's are routinely designed to accommodate narrow 800 V line spikes.

That all sounds pretty alarming, since we are not talking about putting in caps rated at 8X the supply.

The key here is the width of the spike and the inherent suppression of the power supply / line filter. You aren't going to get 8X spikes past the transformer inductance and the rest of that stuff. The open question is weather you will see the 2X spikes.

Better to avoid the 400V parts. Definitely consider major spikes if you are

on the line side of the power transformer.

Date: Thu, 02 May 2013 18:05:11 -0400
From: rbethman <rbethman@comcast.net>
Subject: Re: [R-390] Caps

Personally, I can't help but to agree! I haven't had an issue with caps failing once the old Brown/Black paper caps have been replaced!

Date: Thu, 2 May 2013 22:30:27 +0000 (GMT)
From: chuck.rippel@cox.net
Subject: [R-390] Observation on the Cap Questions and Comments

Some years ago, I did a good bit of research on the question while I was rebuilding my 75A-4 and the first SP-600. The take-away IRT tube radios was GENERALLY as follows:

Electrolytic's are generally used as filters in power supplies; you may see the odd application as a cathode bypass in an audio circuit. The voltage rating of the replacement cap should be such that the applied voltage, be it P-P or DC should not exceed 80% of the rated voltage of the cap.

In circuits in which audio or RF up to but not exceeding 455KC in frequency, Sprague Orangedrops work wonderfully and Orangedrops with Polypropylene media (the more modern 716P Series) in particular, excel in audio circuits.

Circuits which have RF whose frequency exceeds 455KC in benefit from ceramic discs. 1KV rated caps, in my book, are considered a minimum.

As an example, the average SP-600JXxx will need something on the order of 38 0.01 ceramics, 16 0.022 Orangedrops a couple 0.5's and one Multi Section Electrolytic filter cap.

I use 600V, 715P Orangedrops to replace the dreaded C-553. I've not had one fail (that I know of) in 30 years. Because of space considerations I have started using polypropylene media, 630V tubular metal film caps (http://www.tubesandmore.com/products/C-U-630V) in R390A audio deck boards. The .01 audio input coupling cap, buried in that same module will get a .01 Orangedrop or maybe even a .022 if I can squeeze it in. Of course, there is that 8ufd electrolytic which always seems to be leaking acid. A easy to find, 10ufd, 35V axial works just fine there with the (+) lead soldered to the inboard solder pad.

That application will yield about the best >audio detail< and overall sound the radio is capable of giving. In this case, the best possible audio detail is

the goal.

Date: Thu, 02 May 2013 18:58:13 -0400
From: rbethman <rbethman@comcast.net>
Subject: Re: [R-390] Observation on the Cap Questions and Comments

I have to say that I never did any research into capacitors. The ONLY radios I've worked on has been tube radios. I do own two that aren't, but haven't had any part mortality other than a thermal switch in a power supply. That particular repair I resolved by jumpering the failed thermal switch/sensor, and replaced the bushing 12VDC fan with a ball bearing computer CPU fan. It draws less than half of what had been in there as manufactured. Therefore MUCH less stress on the power regulator board.

The tube types have had the same style of component that was there replaced with a like and equally rated or sometimes with a higher voltage rating, and in some resistors, I've upped the wattage of the replacement.

I've never gone out of my way to select foil/film over metalized/film. I've never had a failure in any instance of my replacements. This even applies to those radios that I have helped an aspiring Amateur Operator when they purchased a piece of equipment that I helped them get on the air.

No squawks from them either. Old oil filled caps that developed leaks were replaced with non-oil filled. Perhaps I've been lucky? Or is it that this has been blown way out of proportion? Don't know. The 2 BC-610s haven't complained, nor the Heathkits, nor the Hallicrafters that the BBODs that have had them replaced.

Date: Thu, 2 May 2013 21:38:25 -0400
From: Bob Camp <ham@kb8tq.com>
Subject: Re: [R-390] Observation on the Cap Questions and Comments

There are two reasonable take aways from all this film stuff:

1) If a cap nondestructively popped several times a day, would you notice / would it bother you?
2) Are the self healing pops non-destructive in this or that location.

Both are well worth considering. The other one is - why not just use a ceramic in this or that location?

Date: Thu, 2 May 2013 20:24:00 -0700 (PDT)
From: wli <wli98122@yahoo.com>
Subject: Re: [R-390] caps

Chuck: very succinct and to the point. Nice summary. Way back when I got my first 390A, I followed this path, and have had zero capacitor problems since then (aside from the power supply electrolytics).

Date: Fri, 03 May 2013 06:03:24 -0400
From: "Charles P. Steinmetz" <charles_steinmetz@lavabit.com>
Subject: Re: [R-390] Observation on the Cap Questions and Comments

A few minor quibbles/clarifications:

Power supply voltages pump up and down (e.g., due to turn-on surges, particularly but not exclusively in radios with SS rectifier diodes) and wander around (due to the power company, varying current draw (ovens cycling, etc.), resistive service neutrals, imbalance on the two 120v service phases, etc.). Electrolytics should be chosen so the *maximum possible* voltage they see does not exceed 75-80% of rating. If the radio has been recapped with NOS electrolytics or the electrolytics have been "re-formed," all bets are off.

Any modern film/foil cap will be better than the original paper caps were on their very best day, so in that sense using all ODs (for example) is an improvement over the radio as new. On the other hand, disk ceramics are better bypass capacitors at all frequencies above audio and are just as good, value for value, at audio, so best results will always be obtained with all ceramic bypass caps (audio, IF, and RF). This is particularly true for radios like the SP-600, which have nasty IF and IF harmonic leakage that gets back into the IF and RF stages all too easily. I have done quite a few SP-600s, and have observed a 10-20 dB reduction in spurious responses from changing all of the bypass caps from ODs to disk ceramics. Coupling caps at IF and audio and AGC time constant caps should be film/foil. No ceramic, no mica.

Date: Fri, 3 May 2013 11:07:38 -0700 (PDT)
From: Johnsay Johnsay <groundwave@yahoo.com>
Subject: [R-390] caps redux

I guess I stirred up a bee hive with my original question about caps. What I was hoping to resolve is the suitability of metalized film caps for replacement use in this equipment. There has been a lot of useful information posted but I haven't seen any data that would actually correlate their use with field failures.? Reviewing the archives (pearls) I know they have been used in quite a few cases and they do have their adherents. So what I take away from this, is that I'll use film foil for C553 and C275 (I don't want to have to pull the RF deck out again any time soon). I'll use the Panasonic PP metalized films that I have in stock for the rest. Those would be easier to replace. Interestingly I noticed that R525

had been very crudely replaced, probably while in govt. service due to a failure of BB C539.

Date: Fri, 3 May 2013 14:17:26 -0400
From: Bob Camp <ham@kb8tq.com>
Subject: Re: [R-390] caps redux

As others have mentioned - it'll get pretty interesting packing the plastic caps back in there. Ceramics make that part of it a LOT easier.

Date: Thu, 9 May 2013 14:10:07 -0700
From: David Wise <David_Wise@Phoenix.com>
Subject: Re: [R-390] Caps
Content-Type: text/plain; charset="us-ascii"

After a couple of go-rounds, during which I pressed the tech rep a bit, the result is equivocal. Ignoring my protestations that Mouser stocks FKP1 but not FKP3, he recommended FKP3 "because it is film/foil", without specifically un-recommending FKP1. Sigh.

Date: Mon, 20 Jan 2014 22:51:26 -0500
From: Roy Morgan <k1lky68@gmail.com>
Subject: Re: [R-390] Replacement for C-551?

It would help us whose memory is less than complete (see theory below) if we knew what C551 is.

Date: Mon, 20 Jan 2014 19:58:27 -0800
From: "Craig Heaton" <hamfish@efn.org>
Subject: Re: [R-390] Replacement for C-551?

Well, if it is for a R-390/A; that is a 2uF 500WVDC 10% cap. I've use a NTE MLR205K630, works good last long time. Even fits inside the can of the old oil filled cap.

Date: Tue, 21 Jan 2014 09:01:11 -0500
From: "quartz55" <quartz55@hughes.net>
Subject: [R-390] C551

As I remember I got a couple of 2uF from RS for about $11 that will fit in the can if desired. I'm sure any supply house would have something.

Date: Tue, 21 Jan 2014 20:20:49 +0000 (GMT)
From: chuck.rippel@cox.net
Subject: [R-390] C-551 ?????

C-551 is the big ACG cap on the left, rear of the IF deck. I've never seen one fail but I s'pose its possible. Just lookin at the print, a failed C-551 would cause no/impared SLOW AGC.

Date: Tue, 21 Jan 2014 12:32:57 -0800
From: "Craig Heaton" <hamfish@efn.org>
Subject: Re: [R-390] C-551 ?????

The two R390A's in the shack both had C-551 with poor insulation resistance according to the TO-6A (almost a dead short). While replacing the BBOD's, what is one more cap?

Date: Tue, 21 Jan 2014 12:41:10 -0800
From: David Wise <David_Wise@Phoenix.com>
Subject: Re: [R-390] C-551 ?????

>>> I've never seen one fail ..... <double take> Surely you're joking. Okay, maybe not shorted or opened while watching it, but virtually all paper caps have gone leaky. The entire genus has been "shoot on sight" for over 30 years. The only species that's out of my crosshairs is Vitamin Q. Top-quality ingredients, and most important, hermetic seals. C551 is no Vitamin Q.

Date: Tue, 21 Jan 2014 18:08:35 -0500 (EST)
From: Roger Ruszkowski <flowertime01@wmconnect.com>
Subject: Re: [R-390] Replacement for C-551 2uf AGC cap

I wanted to play with the AGC cap values and some other things to changes the attack and decay times. I found an 8 pin octal socket fits into the round hole under the C-551 can. I plugged and old repurposed 8 pin relay case and plug into the socket. I also rewired the medium AGC cap

into the socket. Then I stuffed the relay case with the cap values I wanted to experiment with. Just one way to redo C551 if you have to.

Date: Thu, 27 Feb 2014 19:23:29 -0500
From: Mark Richards <mark.richards@massmicro.com>
Subject: [R-390] R390 Re-cap kit

It seems like 1,000 years ago that I purchased, likely from someone on this list, an R390a capacitor kit. It consists of orange drops:

4 0.01 uf 400v
1 0.01 uf 600v
7 0.033 uf 400v
2 0.022uf 400v
13 0.1uf 400v
1 CL-80 inrush current limiter

Trouble is, I don't have the paperwork that tells me which capacitors are recommended to be replaced. I've already used the 0.01uf 600v orange drop to replace c553, as this seems a must-do. What capacitors are the most critical to be replaced, given my kit contents? Thank you for your advice,

---

From: barry williams <ba.williams@charter.net>
Subject: Re: [R-390] R390 Re-cap kit
Content-Type: text/plain; charset=ISO-8859-1; format=flowed

Glad Roy helped out. I recently refound my package from boxes of my last move 3 years ago. Those caps were sold by Birmingham Dave. He checked in a long time ago and has vanished again.

Date: Sat, 01 Mar 2014 11:03:33 -0500
From: rbethman <rbethman@comcast.net>
Subject: Re: [R-390] R390 Re-cap kit

There is an unfortunate update on Birmingham Dave.
He's an SK. It's been a good while back. Sorry to have lost him.

Date: Sat, 01 Mar 2014 13:39:32 -0500
From: rbethman <rbethman@comcast.net>
Subject: Re: [R-390] R390 Re-cap kit

Try the entire link:
<http://web.archive.org/web/20090205173103/http://r390a.com/ProbCaps.html>
Also: <http://tinyurl.com/ln9uaq5>

This works MUCH better

Otherwise it came up as unable to load page content.

Date: Sat, 1 Mar 2014 12:52:27 -0600
From: "Bill Hawkins" <bill@iaxs.net>
Subject: Re: [R-390] R390 Re-cap kit

You have replaced the only critical cap. It protects your mechanical filters, (only found in the A version) which are much harder to find and much more expensive than the filters. To be safer, a 1 or 2,000 volt rating would meet the criteria of doubling the safety factor when you are uncertain.

If the kit didn't come with a shotgun for replacing all of the caps, then you are going to save time by waiting until something fails and then replacing it.

Date: Sat, 01 Mar 2014 13:59:27 -0500
From: rbethman <rbethman@comcast.net>
Subject: Re: [R-390] R390 Re-cap kit

You are indeed right on the money!
Chuck Rippel had recommended a 1KV rating for that cap.
I had one on hand, several actually, and used them in my recapping.

Date: Sun, 02 Mar 2014 17:30:47 -0500
From: rbethman <rbethman@comcast.net>
Subject: [R-390] R390 Re-cap kit

I have provided Tom N0JMY with the original Re-cap inventory.
I added the C-553 1KV change.
We will have to wait and see if he can do this kit, and if he will.
Should he do so, and he informs me, I WILL get it to the list.
It's the best I can do. I hope it comes to fruition.
It would be a plus to have a single source for the necessary kit.
It really should reduce the costs to the list.

Date: Sun, 02 Mar 2014 18:58:41 -0500
From: Mark Richards <mark.richards@massmicro.com>
Subject: Re: [R-390] R390 Re-cap kit

That sad information makes my capacitor kit all the more valuable. I really appreciate the work that went into it and Dave's contribution to those of us who restore these wonderful receivers. I did some more looking and came upon a page in the now-defunct r390a.com web site, "Problem

R390a Components" that addresses capacitors.

Available here:
web.archive.org/web/20090205173103/http://r390a.com/ProbCaps.html

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Date: Sun, 02 Mar 2014 19:07:38 -0500
From: Charles Steinmetz <csteinmetz@yandex.com>
Subject: Re: [R-390] R390 Re-cap kit

>We will have to wait and see if he can do this kit, and if he will.

If someone is going to the trouble to put together a re-cap kit, PLEASE get 1kV ceramics (X7R or X7U) for all bypass capacitors, and 600v film-and-foil (NOT metallized film) caps for the few coupling caps (for example, genuine SBE/Vishay/Sprague Orange Drop P225 Series -- but watch out for metallized film "orange dip" imposters sold by some vendors). Also use film-and-foil caps for the AGC capacitors, but you don't need 600v parts there -- 100v is fine.

The ceramics do the job much better than any plastic cap in bypass applications, they are much easier to squeeze into the tight spaces in a 390A, and they are much less expensive as well. Some of the money saved can then be invested in getting high-quality film-and-foil caps for the non-bypass applications without the total cost getting out of hand. And the radios so equipped will have the best parts available for each spot.

A kit should also come with 10 feet of teflon (and only teflon) spaghetti tubing to fit the capacitor leads.

All that said, I am generally NOT a fan of replacing capacitors shotgun-style in a 390A. I have looked after several hundred of them in my day, and am still in touch with the owners of many of them. With a few rare exceptions (notably, radios that had been underwater for a time or were otherwise badly abused, and a very few that seem to have been built with a bad batch of caps), the 390A does not seem to suffer from serial capacitor failure. So, I believe the best approach is to replace the few known troublesome caps and then just run the radio. If you have two or three cap failures within a few years, then you might conclude that you have one of the rare, failure-prone exceptions and consider wholesale replacement.

The above does not apply to the electrolytic filter caps, IMO -- at the first sign of trouble, I'd replace all of them with brand new, high-reliability, high-temperature aluminum electrolytics. At this point (2014), the best commonly available (in the US) high-voltage aluminum electrolytic caps seem to be the United Chemi-Con "KJX" series. For low-voltage

applications (<= 50v), the United Chemi-Con "EKZM" series seem to be the best. Mouser has both, as most of the major parts distributors probably also do.

In brief response to those who may ask, "Why not shotgun the caps -- there's nothing wrong with improving the radio, is there?": To change the caps in a 390A, you are working in very tight quarters, and some of the caps are attached to standoff terminals that are quite fragile and hard to obtain these days. It is almost certain that a person with average electronic construction/repair skills will burn a bunch of wires with the soldering iron and break a few standoffs in the process of replacing all of the caps in a 390A, as well as knacker a few other things along the way. "If it ain't broke, don't fix it" is a valuable piece of advice taught by those with lots of experience.

Date: Sun, 02 Mar 2014 19:16:20 -0500
From: rbethman <rbethman@comcast.net>
Subject: Re: [R-390] R390 Re-cap kit

Would you be so kind to send this to Tom N0JMY?
His Email address is: n0jmy@hayseedhamfest.com
It would be greatly appreciated!
It would make the kit become VERY good!
I do know he provides solder wick in his kits.
I had the teflon tubing in my collection of parts and components, so never gave it a thought.

Date: Thu, 29 May 2014 11:34:14 -0400
From: rbethman <rbethman@comcast.net>
Subject: [R-390] Fwd: Orange Drop capacitors

Just came in on the Hallicrafters list: I recently learned from my sales-rep at MOUSER, that the Vishay/Sprague "orange drop" line of capacitors are to be dropped. Seemingly, they're "obsolete" (guess that means I am too), so for those of you, like me, who enjoy using them for restorations, we'd better find another line to buy.

Date: Thu, 29 May 2014 10:59:34 -0500
From: Chris via R-390 <r-390@mailman.qth.net>
Subject: Re: [R-390] Fwd: Orange Drop capacitors

Dropped from Mouser, or discontinued by CDE? They bought the Orange Drop line from SBE a few years ago and closed the US plant where they were made from day one, in favor of the orient facility.

Date: Thu, 29 May 2014 12:07:31 -0400

From: rbethman <rbethman@comcast.net>
Subject: Re: [R-390] Fwd: Orange Drop capacitors

If Mouser is NOT going to continue to carry them, then is there really any difference?

Date: Thu, 29 May 2014 11:19:10 -0500
From: Ben <brloper@gmail.com>
Subject: Re: [R-390] Fwd: Orange Drop capacitors

Good question, I buy a lot of mine off of Amazon.
Since our problems have been our own creation
They also can be overcome
When we use the power provided free to everyone

Date: Thu, 29 May 2014 13:47:56 -0500
From: Chris via R-390 <r-390@mailman.qth.net>
Subject: Re: [R-390] Fwd: Orange Drop capacitors

Mouser is not the only parts house usable by hobbyists, by a long shot. So yes- difference. Several months ago I stocked up on some 1600v orange drops from Allied or Newark, forget which.

Date: Thu, 29 May 2014 15:27:04 -0400
From: rbethman <rbethman@comcast.net>
Subject: Re: [R-390] capacitors and suppliers

Consider the issues that we went through.

Bob - NODGN

Charles wrote: (3/2/2014)

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Date: Thu, 29 May 2014 14:36:35 -0500
From: Tisha Hayes <tisha.hayes@gmail.com>
Subject: Re: [R-390] Fwd: Orange Drop capacitors

I have a lifetime supply of those caps. I purchased out the inventory from a distributor a few years ago (hundreds of them). For the informed I have 715P (polypropylene) and 225P (polyester) caps. The 715P series caps are more expensive but apparently are better for higher frequencies.

Right now a 0.01 uFd, 400 VDC 716P series Cornell Dubilier cap costs

$2.11 each. If you went 0.01 uFd, 400 VDC 225P series Cornell Dubilier cap the price is around $1.53 each If I had to go with something different I might consider an EPCOS MKP series B32620A4103J 0.0.1 uFd, 400 DVC cap for around $1.05 each

http://www.cde.com/catalogs/715p.pdf
http://www.epcos.com/inf/20/20/db/fc_2009/MKP_B32620_621.pdf

Date: Thu, 29 May 2014 17:15:21 -0400
From: "Dave and Sharon Maples" <dsmaples@comcast.net>
Subject: Re: [R-390] capacitors and suppliers

All: The note from Charles seems sound to me. On the R-390A I did, I went the all-OD route and regretted it almost instantly. I had the experiences that he cited. Never had the courage to go into the RF deck, so mine is still “incomplete" I guess. The only places that seem to sell real film-and-foil caps, though, are some rather esoteric hi-fi places. If there are better sources, I'm all eyes. When I check manufacturer's websites (e.g. Vishay) I don't seem to find the real film-and-foil caps still being manufactured as a product line. I will freely admit that my search has not been exhaustive.

Date: Thu, 29 May 2014 15:25:32 -0700
From: David Wise <David_Wise@Phoenix.com>
Subject: Re: [R-390] capacitors and suppliers

Searching at Mouser, I took a representative value, 0.01uF, 630VDC-2KVDC, stocked only, and added "foil" to the search string. This produced a couple of Wima FKP1 parts. Changing "foil" to "FKP" yielded nine FKP1 and FKP4 parts, ranging from $0.76 to 2.69 . The datasheets say they are film/foil. If you are willing to go down to 400V, you can add one FKS2 part for $0.47 .

If you are 100% allergic to metallization, pass by the FKP4; they are foil/metalized film/foil/film. That still leaves over half a dozen 0.01's. Here are three more film/foil types that don't show up in the above search.

CDE type DMT
CDE type DPP
CDE type WMF

That last is even axial-lead, for you radial-haters. All in stock, and nothing over about $3.

PS - I left out Sprague type 715P since it is said to be on the way out, but they're still in stock. About 1000 715P 600V, less than $3. Casting a

wider net, I see that some values are EOL status but not others.

Date: Thu, 29 May 2014 18:06:43 -0500
From: Chris via R-390 <r-390@mailman.qth.net>
Subject: Re: [R-390] Fwd: Orange Drop capacitors

If you're referring to me, I think you misconstrued something. My point was yes- there is a difference between Mouser ceasing to carry them, and discontinuation- If the prior, they could be sourced elsewhere. If the latter, well then it's time to stock up or find alternates. I'm not "shooting", nor belittling anyone, and appreciate the alert if the Orange Drop lines are indeed being discontinued. Love them or hate them, they have their place in what we do.

Date: Fri, 30 May 2014 06:11:37 -0700 (PDT)
From: Dave Sampson via R-390 <r-390@mailman.qth.net>
Subject: [R-390] r-390A capacitor question?

I'm not busting any chops here, i simply don't have the experience that many of you have... lets say that you are replacing all the capacitors in an r-390a for example: and you were quite satisfied with the stock communications grade audio.

Would it really make a discernible difference in performance depending on what type of capacitor you used...metalized film, foil/film, polystyrene, disc ceramic?

I've heard that some sp-600's used disc ceramics throughout (except for the electrolytic of course). Would love to hear some opinions

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Date: Fri, 30 May 2014 13:26:41 +0000
From: <kirklandb@sympatico.ca>
Subject: Re: [R-390] r-390A capacitor question?

Yes some of the sp-600's use ceramic disks. Not all capacitors are created equal. There are many types of ceramic disk capacitors. I suggest going to a capacitor manufacturer's website and reading some of their application notes. A couple of the reasons for different ceramics:
- temperature drift
- getting a small physical size

Ceramic capacitors can be like little Piezoelectric devices, i.e. they turn ac into sound waves. Can be much more of problem in modern electronics where we fit large value's in extremely small packages

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Date: Fri, 30 May 2014 08:37:11 -0700

From: "Chris Kepus" <ckepus@comcast.net>
Subject: Re: [R-390] r-390A capacitor question?

Not trying to bust any chops here, either. However, certain subjects, i.e. tube shields, capacitor types, line filters, ballast tubes, etc., are like periennal weeds or flowers, they come up every year. The discussions cover pretty much the same ground and due to the fortunate abundance of subject matter experts on this list, some explanations of (fill in one of the above topics) are text book quality. Soooo, if anyone new to the list REALLY wants to know anything about one of the above subjects, they can search the QTH R-390 archives or likely find the topic in a amazing summary of group discussions on these subjects:

http://www.r-390a.net/Pearls/ group

Of course, there's always the possibility that another discussion of capacitors might result in new data.

Date: Fri, 30 May 2014 13:22:47 -0400
From: Charles Steinmetz <csteinmetz@yandex.com>
Subject: Re: [R-390] r-390A capacitor question?

As others have said, there is more than you would ever want to wade through in the archives. Several short answers:

You mention audio, but 98% of the caps in a tube radio (like a 390A) are not in the audio path. The vast majority of them are power supply or tube electrode bypass caps. These days, all of these bypass capacitors should be replaced with 1kV ceramics (type X7R or X7U) because they perform better in that role. They are also much smaller and they are less expensive. Keep leads as short as possible and use teflon spaghetti tubing as necessary to insulate the leads. There are a few coupling capacitors, both IF and audio. Because the types of ceramic capacitors you would use to replace them (X7R or X7U) have high dielectric absorption and high voltage coefficients, they can cause distortion in these roles. Accordingly, these capacitors should be replaced with plastic film capacitors. For reasons I won't repeat here but you can read in the archives, I strongly recommend using only film-and-foil capacitors (not metallized film) wherever you use film capacitors in any tube equipment. I recommend using 600 Vdc capacitors in the 390 and 390A.

The AGC filter capacitors should also be film capacitors. 100 Vdc is sufficient for these.

Repeating: There are only a few coupling and AGC capacitors. Most of the capacitors in the radio should be replaced with ceramics, as noted above.

All of that said, I will repeat something I've said before about replacing all of the capacitors in a radio: <snip>

Date: Fri, 30 May 2014 10:29:00 -0700
From: David Wise <David_Wise@Phoenix.com>
Subject: Re: [R-390] r-390A capacitor question?

I haven't heard of X7U before your post, Charles. Sure you didn't mean Z5U?

Date: Fri, 30 May 2014 13:30:11 -0400
From: Bob Camp <kb8tq@n1k.org>
Subject: Re: [R-390] r-390A capacitor question?

It's a valid dielectric these days.

Date: Fri, 30 May 2014 10:40:15 -0700
From: David Wise <David_Wise@Phoenix.com>
Subject: Re: [R-390] r-390A capacitor question?

I'm behind the times. X7U is rated for bigger temperature extremes than Z5U but the same capacitance tolerance, meaning it *may* be more stable but no guarantee on that. A casual search yielded half a million hits, about four times as many as Z5U, the ubiquitous junky cap of my youth. Looks like it has replaced it.

Date: Fri, 30 May 2014 10:42:06 -0700
From: David Wise <David_Wise@Phoenix.com>
Subject: Re: [R-390] r-390A capacitor question?

But Mouser is too. ~3000 hits on Z5U vs 7 on X7U. Make that "will replace it".

Date: Fri, 30 May 2014 18:16:05 -0500
From: Tisha Hayes <tisha.hayes@gmail.com>
Subject: Re: [R-390] r-390A capacitor question?

One time I was bored and did a components/ value count on the R-390A and was amazed at just how many mica caps there are in the radio. Most of what is in place in the RF and IF decks are pretty high quality components and just shopping out the materials list it came to almost $150 in capacitors if someone was so inclined to shotgun the radio.

Other than the issues with breaking turrets, burning wires, cold solder joints, etc. If you had decided to go that route of a wholesale replacement of every capacitor (where 99% of them are good) you would need to go

through an extensive realignment of the receiver as the ever so slight (but still within tolerance) changes of capacitors is going to cause a cumulative misalignment on every band and with every function.

Saves your money, eutectic solder, teflon tubing, sore eyes and heartache and troubleshoot down a problem to a specific component and just replace that one part. Easter-Egging is a holiday, not a valid troubleshooting technique.

There have been a few lists of capacitor tweaks in the audio chain that slightly improve frequency response and THD. They are in the archives and are a less drastic change than the Kleremonos (spelling) audio mod. If I was to go that route I would just take the diode load output and run it into a good audio amplifier or even a software based DSP.

Date: Fri, 30 May 2014 19:23:09 -0400
From: rbethman <rbethman@comcast.net>
Subject: Re: [R-390] r-390A capacitor question?

On Tisha's note, I only went through a wholesale capacitor replacement on the '51 contract Collins. It was loaded with the notorious BBODs. I had purchased two recap kits from Birmingham Dave when he was on the list and made them available. A '67 EAC only needed the notorious acid type tantalum on the audio board replaced.

Date: Fri, 30 May 2014 23:34:17 +0000
From: <chacuff@cableone.net>
Subject: Re: [R-390] r-390A capacitor question?

Not sure how this gets blown up... I don't remember anyone ever suggesting a wholesale capacitor replacement process in the R-390 series. I would never suggest changing any of the silver micas unless one has proven itself to be bad.

What has been suggested and debated over the years is wholesale replacement of all paper capacitors in the radio's. Many are comfortable with only replacing the filter killer cap in the A and maybe the corroding tantalum and letting the others ride. That's OK too. How can one argue with that logic since the person that is going to have to go back into the set when and if any of the others fail is the owner...so whatever one is comfortable with.

My personal choice is to get all the paper caps out and bring that part of the radio up to date with modern components. I have done several with the Orange Drops over the years but my next one will be ceramics for bypass and film/foils for coupling.

As big an issue with these radio's is out of spec. resistors. We don't talk about that much but probably has more to do with tube life and performance than the caps.

Of late my choice for my personal listening is to rebuild an R-390/URR and skip replacing anything but a few resistors as needed...an added cooling fan and cleaning, lube and alignment. Better sounding radio too...

Date: Fri, 30 May 2014 20:13:38 -0400
From: rbethman <rbethman@comcast.net>
Subject: [R-390] Recapping

The absolutely ONLY reason for my wholesale recap on the '51 contract Collins is not just BBODs, BUT it is also a Blue Striper that was saved from St. J's. It takes a whole lot more to getting it back to right. I obtained an extra chassis due to concerns over the wiring harness and connectors.

Simply put, it is a labor of love. I'm just currently in a holding pattern as the XYL does her final pieces of renovation of the Den/Shack.

I know how far I can push things. She will NOT go for another re-work in the living room as I did in between the renovation work last summer/fall.

That was an HRO-50-T1 that the price was as close to a steal as you can get. I had worked out the price at $50, as offered by the OT-er, but when I went to get it he dropped the price to $25. I was shocked! He just isn't able to get on the air since he moved into a townhouse with a "nazi" HOA that went ballistic when he even tried a stealth antenna. As it was, I had to stop him from handing me everything he had Amateur. He shoved a small Johnson Matchbox and a 150 foot 14 AWG solid roll as I was trying to get the HRO-50 out to the car. I really didn't feel all that comfortable in some regards, but he was very open and a gentleman of the highest caliber!

It was a response to an AM list member's post that started it off. It was by his brother. By cracky! It even worked! I didn't pursue its use further than a quick test. It definitely needed to be recapped. Some resistors were out of value also.

Date: Fri, 30 May 2014 21:21:26 -0700
From: "Craig Heaton" <hamfish@efn.org>
Subject: Re: [R-390] r-390A capacitor question?

I'm tossing this out for peer review. Don't have a nickel in it. Doubt some of the charts will show on this reflector. Tnx, Craig

PS: I've left out the charts. Will provide pdf file to those interested.

K9AXN SERVICE NOTE 022h IMPORTANT CAPACITOR INFORMATION

One of the most frequent errors when restoring vintage radio equipment is removing the paper capacitors and indiscriminately replacing them with Ceramic caps. This seems to be a universally held notion. It is also a fairly sure way to transform a radio that could have performed to factory specs to a mediocre performer. Sound like finger nails scratching on a black board? Sure, but indulge me and read on because the world is not flat. A great case and point is the Hallicrafters SR-2000, SR-400, and SR-150 transceivers as well as the HT-44 transmitter. The popular first thing done is turn the radio over and check for paper caps. If you find any, replace them --- they are evil --- NOT SO!! They are not paper capacitors but expensive very high quality NON-INDUCTIVE film capacitors manufactured by General Instruments. The SR-2000/400/400A/150 transceivers implemented poly-film capacitors that resembled paper caps. They were used in ANALOG CIRCUITS rather than Ceramic capacitors, e.g. the source and sink for the balanced modulator, key click filter, AGC, AALC, and noise blanker time constants, as well as the side tone generator circuits where linearity and stability are a design requirement. Ceramic class 2 and 3 capacitors are not a proper design choice for these functions. This note will provide comprehensive explanations, research papers, and test methods to help you choose the right capacitors for the right functions in your radio.

Note: When I refer to ANALOG, I am speaking to a circuit whose components participate functionally in combination with other components to perform a common task i.e. --- a Tuned resonant circuit, Time constants, Key click filter, coupling to and from the low impedance balanced modulator, and band pass filter circuits that demand linearity in the presence of varying voltage.

Low impedance components that are used to couple high impedance end points are not considered analog participants. The low impedance of the coupling capacitor does not allow a significant AC voltage differential between the plates of the capacitor when coupling high impedance end points.

Low impedance components that are used to couple low impedance end points are considered ANALOG because the coupling capacitor will be exposed to varying voltage.

The film caps used in the SR-2000, SR-400, SR-150, and HT-44 must not be replaced with Ceramic caps. Read on, it will become apparent.

TYPES OF CAPACITORS AND DIFFERENCES IN BEHAVIOR
CERAMIC CAPACITORS:
There are three major classes of Ceramic capacitors; Class 1, 2, and 3, each having different characteristics.

The following is an overview of research data. Please read the included research papers for details --- no point in repeating the data. (www.k9axn.com Service note 23 for links)

Class 1 Ceramic (Low K):
The class 1 Ceramic capacitors are comparable to Mica capacitors; the best there are. They are stable in the presence of varying voltage, very low Dissipation factor, very low Dielectric absorption, very low Hysteresis effect, and they are temperature stable or predictable, and they do not age. They are the COG, NPO, and Temperature compensating i.e. N150, N750 etc. The higher the Negative number in the temperature compensating version, the closer to the class 2 capacitor behavior they become.
Class 1 Ceramic capacitors are generally used in circuits that require temperature, capacity, Hysteresis, and age stability. Critical ANALOG circuits!

Class 2 Ceramic (Medium K):
The class 2 Ceramic capacitor covers a variety of performance characteristics that begin from the very low end Class 1 to the high end class 3 behaviors. Several undesirable characteristics begin to appear in the Class 2 caps and become progressively worse in the Class 3capacitor.

1. The capacity varies significantly with applied voltage and varies differently for AC or DC.
2. Capacity varies wildly with temperature.
3. The Hysteresis effect becomes problematic.
4. They age, losing capacity over time.

These first three vulnerabilities cause distortion, harmonics, IMD, and unpredictable behavior. See the harmonic chart in the Clifton paper. These capacitors can be used for Bypass as well as coupling provided the impedance of the coupling capacitor is significantly lower than the termination.

Class 3 Ceramic (High K):
The class 3 Ceramic capacitor displays all four of the undesirable characteristics of the Class 2 but much more profound. They can be used for Bypass, and with great care coupling, provided you do not care about linearity.

Polypropylene film/foil:
Polypropylene capacitors are acknowledged by some manufacturers as the new Class 1 Ceramic replacement. The electrical characteristics of the leaded Polypropylene, Ceramic class 1, and Mica capacitors are very close to the same.
1. They are non-inductive.
2. The capacity does not vary with applied voltage.
3. They display extremely low Hysteresis effects.
4. The dielectric properties regarding stability and loss are much the same as Class 1 Ceramic capacitors.
5. All work well through the VHF range.
6. They do not age.
7. The dielectric is efficient to well into the VHF range. We measured the apparent Q to 205Mc.
http://www.k9axn.com/_mgxroot/page_10833.html
The following chart represents the Q of a variety of temperature stable capacitors. Pay special attention to the close comparison between the Mica, Polypropylene, and COG class 1 Ceramic capacitors.

Details regarding proper circuit usage:
The capacity of a Polypropylene film capacitor does not vary with applied voltage, age, or exhibit Hysteresis effects as do the popular class 2 (X7R) or class 3 (Z5U) Ceramic caps. The capacity of class 2 and class 3 Ceramic capacitors begins to increase as the voltage is increased, then lose as much as 40% of the original value. The capacity of the class 3 Ceramic cap varies the most.

There is almost immeasurable capacity shift with varying voltage in the class 1 caps.

The varying capacity of ceramic class 2 and especially class 3 capacitors in the presence of more than a fraction of a volt AC will create distortion in an analog application and is a universally inappropriate design. The variation in capacity with voltage is different for AC and DC. In the presence of AC, the capacity begins to vary at less than 1 volt. Why the difference with AC? Because the Hysteresis effect is present beginning with very low AC levels and the general voltage effect at higher levels. Check the research papers, --- any research paper, --- specifically the charts in the Kemet paper. I provided a link to their paper as it is copy right.

Class 3 Ceramic capacitors should be relegated to bypass operations:
Contrary to the universally held notion that they are the best there is for bypass ---- truth be told, that is the only function that they are capable of doing well.

Class 2 Ceramic capacitors can be used for the following configurations:
Bypass: Coupling: From the plate to the output tuned circuit --- because the AC voltage across the capacitor is significantly lower than the plate voltage swing --- about 1/10th. Use a cap with a voltage rating 5 to 10 times the expected voltage swing.
Coupling: In the Pi section output. The voltage is approximately 230vac for a 2000W transmitter and 400vac for a poor SWR. Again, use a cap with a voltage rating 5 to 10 times higher than the expected voltage. Remember, the % of capacity variation with voltage is spread across the full voltage rating of the cap but be aware, it is not linear. A 10 volt variation in a Ceramic 50 volt cap will have a much more pronounced effect on capacity than the same variation in a 500 volt cap.
Low level timing: A timing circuit where you don`t care about linearity. Note, the SR-2000 uses 280v on most plate and 150v on most screen circuits. At 280VDC the capacity of a 500v class 3 capacitor can be up to 30% lower, however, I believe the designers selected component values based on that knowledge. The characteristics of high K Ceramic capacitors were well known in the early 60?s and before. None of this information is new --- just forgotten.

The final compartment SR-2000:

Class 1 and 2 --- no class 3 caps are used.
The coupling from the plate to pi-section is a high quality Centralabs class 2 X5U 5000v door knob cap. The low capacitive reactance of the coupling capacitor limits the AC voltage differential between plates, which is essentially a low impedance coupler to high impedance load. This is appropriate use of the class 2 cap. For the 3.5Mc and 7Mc caps that are switched in the plate side of the final tuned circuit, a class 1 100pf N750 door knob is used; Yes, a class 1 cap. Class 1 caps include the COG, NPO, and temperature compensating caps. They used a class 1 cap because the voltage swing is over 2000v in the tuned circuit which is an ANALOG function by any definition. A class 2 or class 3 capacitor, because they behave like voltage variable capacitors, would have added unacceptable distortion and harmonic content into the final pi-section; remember, the capacity of a class 1 cap does not vary with applied voltage. You will not find a class 2 or 3 Ceramic capacitor that carries circulating current attached to the plate side of any final tuned circuit. Check your transmitter, you will find this to be correct.

The 50 ohm, antenna side of the pi section sees approximately a 225 volt swing at 1Kw out with a good match and maybe 400 volts with a poor SWR. Here they use a high quality, high voltage X5U Class 2 cap. A class 2 capacitor in an analog circuit? They used a 5000v X5U in the output side of the final tuned circuit where the voltage swing is a maximum of approximately 400v. This particular capacitor because of the 5000 volt

rating displays very little change in capacity in the 0vac to 400vac range and is an acceptable design.

Do not arbitrarily grab a ceramic capacitor from your stock to replace a paper or what looks like a paper capacitor thinking it has to be the right choice.

Bypassing a screen, or plate RF cold side with a class 2 or 3 ceramic cap is OK because there is no AC voltage swing to speak of as the cap provides a low impedance path to ground for RF. One caveat, a .01uf Z5U 500v used as a bypass for a circuit that has 280vdc will likely result in a .006uf to.008uf capacitor, not .01uf. The X7R will vary somewhat less than the Z5U. If that satisfies the design criteria, all is good. You will not find a class 2 or 3 Ceramic cap participating as a major Q contributor in the circulating current of a tuned circuit for all of the above reasons!

A common example of paper capacitor terror is the misguided replacement of the band pass caps with Ceramic in the SX-100 and other 50kc I.F. systems: bad choice, use film. FACT: Polypropylene caps do not have the frailties inherent to class 2 and 3 Ceramic caps. The capacity varies insignificantly with voltage, and they are not plagued with Hysteresis effects like the class 2 and 3 ceramic caps.

The notion that the Polypropylene dielectric is lossy at high frequency is absolutely absurd. I have tested the Q of Polypropylene caps to over 200Mc and find their Q to be => than Ceramic class 2 or 3 caps and stability superior; See the video.

The manufactures data sheets for polypropylene caps specifically state that they are non-inductive and can be used to their self-resonant frequency just like any other cap. The inductance that they present is actually =< to that of a straight length of wire. A one inch length of #22 wire exhibits about 22nh of inductance. If you short the leads of a capacitor using a flat copper strap 1/8 inch wide, 1/4 inch long to minimize the connection inductance of a .001uf Polypropylene metal foil cap, it is self-resonant at approximately 76MC. Calculate this, it represents approximately 6.0nh ---- the total inductance of a 1/4 inch length of #22 wire. We tested several .001uf Ceramic caps shorted in the same manner; the result --- self resonant, but at approximately 65Mc. See the video and repeat the test yourself --- you will find it interesting.

Comparing the apparent, not measured Q at 65Mc for both gives the Polypropylene caps a 130/100 advantage over the Ceramic caps. The Polypropylene dielectric outperforms the class 2 and class 3 Ceramic capacitors regarding stability and Q to well above their series resonant frequency, where BOTH, the Ceramic and Polypropylene film caps become

inductive albeit no more so than a straight length of wire. A 500pf Polypropylene metal foil cap is series resonant at approximately 105Mc and continues to display an => Q than Ceramic caps

Is the Q important? Of course! The Q of a capacitor is the opposite of Dissipation factor i.e. Admittance and resistance. The dissipation factor limits the maximum frequency that is usable.

Dissipation factor is composed of two properties, ESR and Dielectric Absorption. The ESR is simply the combined resistance of the connections. Dielectric Absorption is a result of the dielectric charges lagging in their return to their natural state --- like an old soggy rubber band compared to a new one. Dielectric absorption results in energy being expended to force the charges back to their natural position generating heat and is defined as the Hysteresis effect which is insidious for linearity.

You will find this butterfly chart and narrative at the end of the Clifton Labs research paper clearly displaying the Hysteresis behavior of Ceramic class 2 and 3 caps. The capacity at a particular voltage varies radically. Please pay close attention to this chart. The hysteresis effect is as old as Ceramic capacitors. If you have not seen or heard of the effect, we will provide a simple test procedure and video that you can use to compare two capacitors to determine which has the better Dielectric Absorption factor. You will find this a very interesting exercise!

Here is an interesting story. Everyone has heard about the carbon dating of some object. We also know that the resistances of vintage carbon composition resistors are universally quite high over time. What we tend not to know is that ceramic capacitors age as well. The class 2, X7R age at approximately 2% per decade and the class 3 Z5U approximately 5% per decade. Don?t believe this? Clip a cap out of an SR-2000/400/400A or any vintage radio and measure the capacity. You will find them down from 10% to 25%+ depending on the age and class. Check your inventory. Take it a step further and restore them to their original state. Place them in a coffee cup and bake them at 150C degrees for 1/2 hour or 125C degrees for 1.5 hours let them cool for 24 hours and re-measure. The crystalline structure is now recovered and their values are as new. One caveat, the aging process begins again. Note, that not one of the film capacitors is degraded. No, the baking process does not hurt the capacitor! What temperature is Ceramic fired, what temperature does solder melt, and one further note; the baking process was used by some manufacturers to adjust the values to tolerance --- CHECK THE KEMET OR ANY OTHER RESEARCH PAPER AS TO WHETHER THIS PROCEDURE IS HARMFUL
Note: The Class 1 NPO/COG or temperature compensating ceramic caps do not display varying capacity with applied voltage, the aging problem, or

profound Hysteresis problems as do the class 2 and class 3 ceramic caps.

Seems to require a million words to express a concept, and it?s easy to warp the meaning of the written word; as you have read in the frequent diatribes on the various reflectors. The fundamental reason for this service note is the flawed notion that any time you find a tubular or what you believe to be a paper capacitor in a vintage radio, replace it with a disc Ceramic cap. Use polypropylene if you are not sure.

Review the circuit and if it has an analog personality, or you care about linearity and stability, use Polypropylene film, Mica, or class 1 (NPO, COG, or any of the temperature compensating Ceramic capacitors). Would you use a voltage variable capacitor, which is the behavior of class 2 (X7R etc.) or class 3 (Z5U etc.) disc Ceramic capacitor as a major component of a tuned circuit? The people who designed the radios didn?t think so. If you must use a disc Ceramic capacitor, use the class 2 cap with a voltage rating as high as you can find that will fit. TEST it`s personality first. These capacitors vary radically even within a batch. They should be tested before use. The test methods and setup are included in video format in these notes. You will be stunned by the vast variations between Ceramic class 2 and 3 capacitors with the same values marked.

We will provide a video of a new disc Ceramic cap that measures great for capacity but has almost no Q, and when subjected to 50% of its rated voltage has lost 90% of its capacity. This is a must see! If you have purchased some of the new Blue caps, watch this one! NOTE: See photos of the tests and instrument setups (service note 23a) that can be used to verify these findings and review any of the numerous research papers including the links at the beginning for more information. Do the calculations and measure the self-resonant frequency of a .01uf capacitor -- IT CANNOT BE SELF RESONANT AT ANYWHERE NEAR 30Mc, THEORETICALLY OF PHYSICALLY WITH ?? LEADS OR WITH A DEAD SHORT! There is an old and very misguided myth that a .01uf Ceramic leaded capacitors with ? inch leads is self - resonant at over 30Mc. Do the math. Test it yourself, and check the research papers. Best you can do with the leads shorted directly together is 21Mc and with ? inch leads maybe 11Mc. This is confirmed in any research paper.

Do the self-resonant measurement as viewed in the video.
Do the measurement for capacity change with voltage variation test: you can tell
a good deal about a capacitor with it.
Do the hysteresis comparison test.
Do the Dissipation comparison test.

They are simple and you can prove to your satisfaction that you can

choose the right capacitor for the right application without having to depend on Myths, legends, hysterical campfire talk. I will provide videos of the tests and setups. They are incredibly simple and interesting. I will be happy to respond to any courteous question and hope you find this interesting. If it is unclear, please send a note describing the content and we will fix it. Thanks and a good day to you. Kindest regards Jim K9AXN.

Date: Sat, 31 May 2014 10:18:30 -0700
From: "Craig Heaton" <hamfish@efn.org>
Subject: [R-390] The Lowly Capacitor

Thru the years it has been fun & interesting to follow/read comments on "which capacitor". So the following poor man's view is offered, again. At my location/QTH the RFI level on the R-390A's is never below 20DB using the carrier level meter. Plug an Icom or Yaesu into the antenna and I never see anything less than S9. The RFI is from the neighborhood, everything in my house that could radiate RFI is unplugged. Taking one of the mentioned Riceboxes on a trip out of town using my Chevy Blazer, I have to drive 5 to 9 miles out of the Eugene/Springfield area, turn off the Blazer & be somewhere in the Willamette National Forest to get away from the RFI. With that said, a man has got to know his limitations. If I could only live in Greenbank, WV. Then have the time & money to experiment with different capacitors.

Date: Sat, 31 May 2014 14:48:35 -0400 (EDT)
From: Roger Ruszkowski <flowertime01@wmconnect.com>
Subject: Re: [R-390] The Lowly Capacitor

I understand your RFI problem.
I did 20 years in LA and San Diego.
Every exchange I make was an amazing effort to get past the local RFI.
How are we to do science in RF with such background noise?

Date: Fri, 13 Jun 2014 04:37:56 -0400
From: Jeff Adams <physicist@cox.net>
Subject: [R-390] Orange drop capacitors
I'm a practicing engineer. (obviously because I have not trained enough..) This link was in one of my tech journals today, thought many would like to read it.

http://www.electronicproducts.com/Analog_Mixed_Signal_ICs/Sensors/Orange_Drops_Busting_Tone_Control_Capacitor_Myths.aspx

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Date: Fri, 13 Jun 2014 10:52:57 -0400
From: "KR4HV" <kr4hv@numail.org>
Subject: Re: [R-390] Orange drop capacitors1

I had heard a rumor that orange drops were being discontinued. When in doubt, go to the horse's mouth. I contacted CDE regarding our beloved orange drop caps. My inquiry and their response is below.

Here are the product data sheets from CDE's web site,
http://www.cde.com/ (nice site) as of today 13JUN2014.

http://www.cde.com/catalogs/716p.pdf
http://www.cde.com/catalogs/715p.pdf

Regards, Walt KR4HV

Hi Walt,
We are not discontinuing at all! We purchased the line from SBE and are continuing to build . Our lead times are extended right now because of backlog and we had to stop production when we moved the equipment from VT to Mexicali , but we have no intent to discontinue. Many if our distributors have put in stock as well. (see Cde.com for our distributor list) Thank you, Holly

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Date: Mon, 16 Jun 2014 16:35:56 -0400
From: "KR4HV" <kr4hv@numail.org>
Subject: [R-390] Technical Information about a CDE Orange Drops

Someone posted previously that Mouser was planning to stop carrying "Orange Drop" capacitors. In regards to that post, Mouser's response is below for your review.

From: orders@mouser.com [mailto:orders@mouser.com]
Sent: Monday, June 16, 2014 12:55 PM
To: kr4hv@numail.org
Subject: Re:FW: Technical Information about a Product

Hello John,

Thank you for your request. CDE has purchased Vishays orange drop capacitors and currently we have no indication that these capacitors will be discontinued. Please let us know if there is anything else we can assist you with or if you have any questions. Thank you for choosing Mouser.

Sincerely,
Mouser Technical Support
Mouser Electronics, Inc.
(800) 346-6873
www.mouser.com

Date: Mon, 4 Aug 2014 14:13:45 -0700
From: David Wise <David_Wise@Phoenix.com>
Subject: Re: [R-390] CAPACITOR FIGHT

I tried to calculate the reliability of film/foil vs. ceramic for C553 and got unclear results; it depended on the method I used. Both types had a definite voltage derating effect; if you pick something rated at 1kV or more, it's overwhelmingly likely that your cap will outlast many generations, which realistically speaking is so far in the future it's meaningless.

Do burn in your part before installing it, by floating it at its rated voltage and temperature for a few days. If it gets past that, you're not likely to see an infant-mortality event.

I also simulated a metalized-film self-heal event in SPICE, and got an 80mA current peak that lasted 10us. I don't think this will heat the wire enough to fuse it, but who wants to test it when film/foils are still readily available?

Date: Mon, 04 Aug 2014 18:22:57 -0700
From: John <jlkolb@jlkolb.cts.com>
Subject: Re: [R-390] CAPACITOR FIGHT

What RF voltage is across the filter? Anyone ever considered protective zener diodes?

Date: Tue, 05 Aug 2014 09:20:34 -0400
From: Charles Steinmetz <csteinmetz@yandex.com>
Subject: Re: [R-390] CAPACITOR FIGHT

>I tried to calculate the reliability of film/foil vs. ceramic for
>C553 and got unclear results

There are other important factors to consider besides reliability. Unless the ceramic is type C0G (NP0), the voltage coefficient of capacitance, dielectric absorption, and dissipation factor can cause unwanted distortion in the IF. 0.01uF, 1000v C0G caps are available (e.g., AVX SV01AA103JAA), so this is an option.

Maybe it's just tradition, but I think I'd still rather use a film-and-foil.

>I also simulated a metalized-film self-heal event in SPICE, and got
>an 80mA current peak that lasted 10us. I don't think this will heat
>the wire enough to fuse it, but who wants to test it when film/foils

>are still readily available?

80mA is a lot of current for the tiny wire in a mechanical filter drive coil. Also, once a metalized film cap starts having self-healing events, they tend to become more and more frequent. No, thanks!

Date: Tue, 5 Aug 2014 09:42:19 -0700
From: David Wise <David_Wise@Phoenix.com>
Subject: Re: [R-390] CAPACITOR FIGHT

For C553, TC, VC, DF, DA, even IR and piezoelectricity, are irrelevant if held to real-world limits. As long as it doesn't short-circuit, you're golden. (Or open, but most failures are shorts.)

I've read that about self-heals too. Unless the material and construction are closely controlled, each self-heal event contaminates the surrounding dielectric. If you keep cranking the juice, eventually they'll cascade to a short. There are papers about specific metallization alloys, how thick a dielectric to use, and how tight to wrap it, all looking for the sweet spot where this happens the least.

Date: Tue, 5 Aug 2014 09:47:22 -0700
From: David Wise <David_Wise@Phoenix.com>
Subject: Re: [R-390] CAPACITOR FIGHT

Down in the millivolts, I think. Correct me if I'm wrong, but I believe the resistance is low, which means that nothing can shunt away a current surge.

Date: Tue, 05 Aug 2014 12:16:05 -0700
From: John <jlkolb@jlkolb.cts.com>
Subject: Re: [R-390] CAPACITOR FIGHT

Good point - Collins filter coil resistance is usually in the 50 - 80 ohm region. Any zener low enough to offer protection would probably create IMD.

Date: Tue, 5 Aug 2014 12:39:11 -0700
From: David Wise <David_Wise@Phoenix.com>
Subject: Re: [R-390] CAPACITOR FIGHT

I just had a brain-wave. It might be possible to put a current limiter in series. The Supertex LND150 is a 500V depletion-mode MOSFET that Mouser sells for $0.50. Connect gate to source, and voila, drain current is limited to Idss, about 1mA. Below that, it looks just like a 1k resistor (RdsOn). The driving impedance is the previous tube's plate resistance,

which should swamp a measly 1k.

If this works, you can LAUGH at C553! Somebody try this. Other projects are taking all my time right now.

Date: Tue, 05 Aug 2014 19:29:10 -0400
From: Charles Steinmetz <csteinmetz@yandex.com>
Subject: Re: [R-390] C553

Not so. I was easily able to see additional IMD on the spectrum analyzer when I replaced C553 with a Class II ceramic (e.g., Z5U or X7R). A Class I ceramic (COG/NPO) should solve that problem. Film-and-foil caps also do not generate measurably increased distortion. So, if one decides to use a ceramic for C553, one is well advised to use a COG/NPO type. They're harder to find, but they're out there (e.g., AVX SV01AA103JAA).

Date: Tue, 5 Aug 2014 16:42:43 -0700
From: David Wise <David_Wise@Phoenix.com>
Subject: Re: [R-390] C553

Thanks, Charles, I stand corrected. I totally would not have expected that, because the voltage across the cap is basically constant. I guess even tiny changes can make a difference in some circumstances. The only 1KV COG part at Mouser is SV14AA103KAR, at $6.69 each. There are several film/foil models for less. I wouldn't be surprised if my current limiter idea had the same problem, but I don't have the wherewithal to set it up and measure it.

Date: Wed, 6 Aug 2014 00:40:14 -0700
From: Larry H <dinlarh@att.net>
Subject: Re: [R-390] C553

Charles, I've known about the killer C553 cap for a long time and have installed high voltage reliable caps in there to hopefully save my filters from destruction. What cap would you recommend for C553?

David, your idea about a current limiting device in that circuit got me wondering - what about the most basic one we use all the time? A tiny little solder in fuse of some reasonable value. Any drawback to using a fuse?

Date: Wed, 06 Aug 2014 13:24:33 -0400
From: Charles Steinmetz <csteinmetz@yandex.com>
Subject: Re: [R-390] C553

I have always used 600v SBE Series 225P, 418P, or 715P Orange Drops,

but any 600v film-and-foil (NOT metallized film) cap should do fine. (If you use a Series 715P polypropylene, you can get 800v or even 1200v if you feel the need. Note that the 715P Series are larger, because the dielectric constant of PP is lower than that of polyester.)

I'll take this opportunity to say once again that the vast majority of the paper caps in a 390A (or any tube boatanchor) are RF bypass caps on power supply lines and tube electrodes. These bypass capacitors should be replaced with ceramic caps, because they do the job better than plastic or paper caps. 1kV Class II (Z5U or, preferably, X7R) caps are fine in these applications (but not for C553, which is a signal coupling cap).

Date: Wed, 6 Aug 2014 10:26:54 -0700
From: David Wise <David_Wise@Phoenix.com>
Subject: Re: [R-390] C553

A fuse is way too slow; the filter will go first. Not to steal Charles' thunder, but a while ago I researched 1kV film/foil .01's stocked at Mouser. At the present time, they have exactly one honest-to-god film-foil at 1kV or up:
CDE 715P103516LD3 1.6KV $4.04

The Kemet PHE448 series is also true film/foil but they're out and not ordering. Everything else is either 630V or less, or contains metalized film. If the 1.6kV 715p's run out, you can go two ways with film: either settle for 600V, or settle for metalized and run up the voltage to reduce the odds of a self-heal event. There are in-stock hits for either approach. Here are the film/foils:

CDE
 715P10356KD3 600V $2.34
 DMT6S1K 630V $1.55
 WMF6S1K-F 630V $2.24 >>> AXIAL LEADS

All the over-1kV metalized caps are multi-section design, essentially two or more caps in series. A few of these are hybrids, with foil main electrodes sandwiched around floating metalized film(s). I don't know what that does for the statistical self-heal rate, but here they are, since they're also a minority:

CDE
 942C20S1K-F 2KV $3.26 >>> AXIAL LEADS
 DPPM20S1K-F 2KV $3.09
EPCOS
 B32633A2103J10 2KV $2.17
KEMET
 R73TN2100SE00J 1.6KV $0.98

WIMA
 FKP1U021006B00JYSD 2KV $2.69
 FKP4U021005G00KYSD 2KV $1.91
 FKP1Y021006F00KYSD 6KV $2.84 >>> THIS THING IS HUGE

Finally, there's the single C0G ceramic:

AVX
 SV14AA103KAR 1KV $6.69

Failure rate takes off as you approach rated voltage. Although they used the best grade of part, MIL-HDBK-217 didn't exist, and Collins only derated 30%, where today 50% is understood to be the minimum. That 300V cap should have been 400 or maybe even 600. We're using 1000 - 80% derating - so we can sleep extra easy.

Myself, I'm using an El-Menco .01/1600 dipped radial. I tore one open to confirm it's film/foil.

Date: Wed, 06 Aug 2014 13:53:50 -0400
From: Charles Steinmetz <csteinmetz@yandex.com>
Subject: Re: [R-390] C553

Honestly, I see no need for a rating > 600v if you use a quality film-and-foil. I have never observed a failure (or even heard of one) of a 600v Orange Drop 225P or 715P in the C553 position (or even a 400v 225P or 715P, which many folks use). I've personally installed well over 100 of them, and lots of other people use them, so there is a large information base.

>or settle for metalized.....

Unfortunately, testing I did some years ago does not support the proposition that self-healing events in metallized film caps go down as the voltage rating increases, once the circuit voltage is greater than about 200v. I suspect the catastrophic failure rate does go down with increasing voltage rating, but the self-healing kills filters and it does not seem to. (Note that manufacturers do not consider self-healing events to be faults or failures -- they are part of the normal operation of metallized film caps.)

Date: Wed, 6 Aug 2014 11:49:51 -0700
From: David Wise <David_Wise@Phoenix.com>
Subject: Re: [R-390] C553

Thank you for your testing, Charles, I wondered about that. It's great to

have it nailed down. That narrows it to pure film/foil or COG ceramic.

C553 REPLACEMENTS IN STOCK AT MOUSER, AUGUST 2014

PURE FILM/FOIL
CDE
 715P10356KD3 600V $2.34
 715P103516LD3 1.6KV $4.04
 DMT6S1K 630V $1.55
 WMF6S1K-F 630V $2.24 >>> AXIAL

COG CERAMIC
AVX
 SV13CA103JAR 630V $4.16
 SV14AA103KAR 1KV $6.69
TDK
 FK22C0G2J103J 630V $1.26

Date: Wed, 06 Aug 2014 16:31:08 -0400
From: Charles Steinmetz <csteinmetz@yandex.com>
Subject: Re: [R-390] C553

If you look in the archive, there are posts beginning on 4/24/13 in which I summarized the testing I had done.

Date: Wed, 6 Aug 2014 14:50:30 -0700
From: David Wise <David_Wise@Phoenix.com>
Subject: Re: [R-390] C553

Thanks, I found it. Good reading on April 28. Geez, we talked about the same thing. I had completely forgotten the previous go-round, so we are just recycling an old topic. I think that's half the traffic on this list! :) Consider my previous post the yearly stock update. That several hundred ohms series resistance might have limited the event energy; optimum self-heal might require a low-impedance source, same as tantalum electrolytics. Do you know if the manufacturers claimed that the energy stored in the cap is enough for a good clear?

It's interesting that your test protocol included power-off/on cycles. I seem to recall that at least one of the reliability predictors factored this in, and it had more effect than I expected.

Date: Wed, 06 Aug 2014 21:44:17 -0400
From: Charles Steinmetz <csteinmetz@yandex.com>
Subject: Re: [R-390] C553

I get the impression that a typical MF cap clears with its own charge. The clearing energies disclosed by manufacturers are substantially less than the energy typically stored in HV capacitors. Also, note that the capacitor's internal resistance and inductance impede the flow of energy from the capacitor terminal to the fault, even if the power supply is connected to the capacitor terminal through a low impedance.

C553 operates with a much greater source impedance than my test circuit (2.2k + 12mH, although C511 complicates the calculus), so clearing of C553 wouldn't be any better than in my test circuit even if the series impedance does matter.

>It's interesting that your test protocol included power-off/on >cycles. I seem to recall that at least one of the reliability >predictors factored this in, and it had more effect than I expected.

Yes, power cycles are stressful to caps, even if the dv/dt is significantly limited by the circuit. This is especially true of metalized-film caps, which use vanishingly thin dielectric sheets and therefore have extremely high field gradients. Every time you charge or discharge a cap, things move under these extreme forces both at a microscopic level and at a molecular level.

Date: Thu, 7 Aug 2014 20:49:15 -0400
From: Gmail <wewilsonjr@gmail.com>
Subject: [R-390] Fwd: 2 questions from a new user

One of my favorites from Nolan:

> From: Nolan Lee <nlee@gs.verio.net>
> Date: June 6, 2000 at 11:47:06 PM EDT
> To: r-390@qth.net
> Subject: RE: [R-390] 2 questions from a new user
> Reply-To: Nolan Lee <nlee@gs.verio.net>
>
> At 07:21 PM 6/6/00 -0400, you wrote:
>
>> I thought the metal-cased Vitamin-Q caps were the ones to get rid of, and
>> that the yellow-waxy ones held up better. Now, I hear the opposite.
>
> Change ALL of the paper caps, period. It's cheap insurance. Undoubtedly
> someone will tell you otherwise. I've listened to people bitch and
> moan about the amount of effort it takes sine I first brought up the
> idea back in late 1998 but it's well worth doing.
>

> "Ooh, it's too hard and I might burn my little fingers or break a nail."
> "I'll miss Star Trek tonight..."
> "Whine whine, I've got a hot date with a pair of Swedish nympho twins".
> "My dog chewed the cord off of the soldering iron."
> "The voices in my head said not to."
> "Those caps have worked fine for the last 45 years, why?"
> "If it ain't broke, don't mess with it."
>
> Yeah, right. Who needs Gatling guns, we can travel faster without
> them....
>
> I've listened to dozens of reasons why there is no need to change
> them and it's a wasted effort, etc. I still think that for the person
> that actually uses their radio and doesn't have it as a trophy sitting
> on a table somewhere where they stare at it while they drink some
> sissy drink like lite beer or some twisted version of coffee that
> doesn't even contain chickory, and intend to keep the radios for
> the duration, should put forth the effort and change the caps.
>
> Yep, it's takes time, and the IF deck is a pain in the ass. I'd
> guess that doing nothing but changing the paper caps themselves
> in the radio will easily eat up 15 or 20 hours if you take your time
> and are very careful and cautious. You end up spending more time
> than that because while you have the beast apart, you'll want to
> check the value of all of the carbon composition resistors and
> replace the ones that are out of spec. Cut up a beer can with a pair
> of scissors and make yourself some assorted sized of soldering shields
> to protect the wiring harness, etc while you're soldering. Pick up
> three of four hemostats for heat sinks, to clamp to the leads of
> any carbon composition resistors that happen to share a common solder
> connection with some of the caps you'll change. This decreases the
> change of changing their values up out of spec.
>
> It takes effort, but that's nothing compared to spending days or
> weeks tracking down little quirky AGC problem and a host of other
> problems that over time, I can almost guarantee you 100% that you
> will have with those 35 to 45 year old paper caps.
>
>> Are the yellow waxy caps really that bad? If so, I have a lot of
soldering
>> ahead of me...
>
> They aren't anywhere near as bad as the old brown tubular caps, but
> we're still talking about 30+ year old paper capacitors. ;-(
>
> Do one module at a time. Pull the RF deck for a good cleaning, and

> mechanical alignment. While it's out, change the three axial leaded
> paper caps and test the hell out of the stud mounted one next to
> the 6DC6. If it's less than perfect, change it. It's seldom
> that if fails but test it while you have easy access to it. As a
> rule the oil filled paper caps are probably the most reliable paper
> caps made. I've got some here that are pre WWII and they are
> perfect.
>
> The next time you fell energetic, pull the AF deck and replace the
> caps under it, they're a snap. Also replace the axial leaded tantalum
> while you're in there.
>
> Save the pain in the ass IF deck for last. You can knock it out
> in a couple of two or three evenings of "casual" work. Remove the
> BFO osc can and the long shaft for the bandwidth switch and it
> makes the job much easier. Be very careful with the insulated posts
> that some of the caps attach to. Too much heat for two long of a
> period of time and they break very easily.
>
> Replace the caps in a logical order and try to duplicate their
> positions and routing of the leads as closely as possible.
>
> I've owned and played with R390A's since the mid 1970's. This
> last one that I did, I replaced all of the paper caps in and took
> a lot of steps to make sure that it would be reliable as possible
> when I was done. As of today, it's been running twenty four hours
> a day and seven days a week since the overhaul which I finished
> back on the 13th of October of 1998. A little quick math shows
> this to be in excess of 14,000 hours. That's 14,000 hours in a
> an uninsulated masonry building with temperature extremes of below
> freezing in the Winter and well over 115 degrees during the Summer.
> Let's not forget the humidity down here in South Louisiana either.
>
> It's sitting here running on a variac at 114 or 115 volts as I type
> this. The electrical and physical alignments are still solid, the
> sensitivity is still wonderful, and other than changing out a few
> tubes a while back, nothing has been done to it in this time period.
>
> I have never had an R390A give this level of reliability even back
> in the 1970's when the radios were twenty five years newer than
> they are today. That's not saying that it won't try to burn the shop
> down tonight while I'm sleeping or try to electrocute me the next
> time I go to adjust the volume or something, but I kind of doubt it.
>
> thanks,
> nolan

>
>
> "if you see us running, catch up"
> bomb squad motto

Date: Wed, 17 Sep 2014 14:30:24 -0400
From: rbethman <rbethman@comcast.net>
Subject: [R-390] Was - AGC voltage issue - Now - Original cap kit by Birmingham Dave.

Going back to November 2007, <DAVEINBHAM@aol.com>, was putting together re-cap kits for the R-390As.

The kit consisted of: R-390A capacitor kit
I have put together a ReCap kit for the R-390A.
It consists of:

(13) 0.1 ufd, 600 V
C256, C309, C504, C505, C517, C521, C528, C531, C536, C538, C543, C547, C548

(7) 0.033 ufd, 600V
C275, C529, C533, C534, C541, C545, C602

(7) 0.01 ufd, 600V
C549, C553, C601, C604, C605, C607, C608

(3) 30 ufd, 300V electrolytic C603A, C603B, C603C
(2) 47 ufd, 300V electrolytic C606A, C606B

(The above electrolytics have axial leads. You can wire them under the chassis and leave the originals in place to retain stock appearance. Or you can order capacitors small enough to fit inside the cans of C603 & C606. Just
remember you will have to deal with the Dreaded Black Ukkumpucky to get the
guts out of the cans C603 & C606. If you do not specify at the time of your order, the under the chassis capacitors will be shipped.)

Finally,one each of:
0.047 ufd. 100 V C227
8 ufd 30 V tantalum electrolytic C609
50 ufd 50 V electrolytic C103
0.22 ufd 100V C101

I cannot find a source for:

2 ufd 500 V C551 oil filled paper

so, I will I will include a very high quality poly cap. I have installed one of these in one of my R-390A's
* *
This was a very large black poly cap rated at 500V. I procured two of these kits from Dave, no longer with us, and wouldn't remotely recommend *anything* less than a 500V Poly Cap for C-551

Date: Wed, 17 Sep 2014 15:01:47 -0500
From: Barry Williams <ba.williams@charter.net>
Subject: Re: [R-390] Was - AGC voltage issue - Now - Original cap kit by Birmingham Dave.

I think it was recently said that Dave has passed. It was always good to have him around. He bought the parts at a discount through his job at one of the clinics/hospitals at UAB. His supervisors were nice enough to let him add radio needs to job orders.

I have one of his packages that include the caps for doing the large cans. I can't remember what I paid way back then, but it was probably bumping $90. I would like to sell mine to anyone who wants the whole package. It has all of the caps and the info sheets, and parts inventory sheet. Contact me off list.

Date: Wed, 17 Sep 2014 14:21:39 -0700
From: Bill Guyger via R-390 <r-390@mailman.qth.net>
Subject: Re: [R-390] Was - AGC voltage issue - Now - Original cap kit by Birmingham Dave.

Hayseed Hamfest has reproductions of the multi section Electrolytics in stock.

Date: Wed, 17 Sep 2014 16:42:18 -0500
From: Barry Williams <ba.williams@charter.net>
Subject: Re: [R-390] Was - AGC voltage issue - Now - Original cap kit by Birmingham Dave.

I was listing the few caps added to the base package for doing your own.

Date: Wed, 17 Sep 2014 18:06:00 -0400 (EDT)
From: Barry <n4buq@knology.net>
Subject: Re: [R-390] Was - AGC voltage issue - Now - Original cap kit by Birmingham Dave.

I just know I'm going to get a bunch of "well, that's a stupid question",

replies but I'll ask it anyway. If the electrolytics are rated at 300V, why would any other cap in the system need to be rated higher than that? I've put 400V ODs in for C553, et. al., but now am wondering if those are at risk.

Date: Wed, 17 Sep 2014 16:53:21 -0700
From: Norman Ryan via R-390 <r-390@mailman.qth.net>
Subject: Re: [R-390] Was - AGC voltage issue - Now - Original cap kit by Birmingham Dave.

Actually, it's not a stupid question. (Now taking a wide sidestep.) If there is concern about voltage spikes, especially on start-up, what about using a variac? Doing so resolves the spiking problem, and additionally helps extend tube life and that of other components such as aging electrolytic filter capacitors. Another advantage to using a variac is being able to set the AC power input to the nominal 115 VAC -- or to 110 VAC (no lower). Most American line voltages are too high for comfort at 125 VAC or greater. Given that these rigs are upwards of sixty years old, IMHO it's sensible to proceed this way, especially in light of diminishing working spare modules, etc.

Date: Fri, 24 Oct 2014 17:08:56 -0400
From: Alan Victor <amvictor@ncsu.edu>
Subject: [R-390] Megger and Capacitor Measures ... Good vs. Bad ?

I have been playing with a 500V Megger looking at questionable capacitors in the R-390A. Somewhat of a challenge to determine is this really a bad cap or borderline ok. After looking at a few known good caps, it became apparent that a baseline for good versus bad would be useful. As it turns out, this work was already done very nicely back in 1955 by a couple of folks at the Diamond Ordnance Fuze Labs in Washington, DC. They plot the MEGOHM x MICROFARD product for a variety of caps from the time, namely mica, ceramic, paper, glass, and some poly plastics. At room temp, all of these caps fall in the range of 4-6.2 (meg x uf) product! Hence, a 47 uF looks like about 100k ohm while a .01 uF should look like 400 -500 meg ohms (infinity!). Handy to know and this is about what I saw on the Megger. Their applied V is in this work was ~ 200 V. Curious if any of the folks on the list have established a neat pass-fail criteria.

Date: Fri, 24 Oct 2014 18:54:32 -0700
From: "Craig Heaton" <hamfish@efn.org>
Subject: Re: [R-390] Megger and Capacitor Measures ... Good vs. Bad ?

Four hours and no one has touch it yet, here goes.

Shortly after the first R-390/A followed me home, the question of good vs.

bad arose. Next step was a Sprague TO-6A capacitor analyzer purchase & downloaded the manual from BAMA. You might want to take a look at the manual, good reading.

Short version: One end of the capacitor has to be disconnected in order to test. In other words, it (the capacitor) is half way out. Would it just be easier to replace? If your receiver has those BBOD's, it isn't worth the time messing with them. They are bad, duds, served their country well; replace them with something newer.

Asking what type will start the capacitor wars here on this e-mail reflector. The dead horse will be resurrected and beaten to death once more. But the discussions are fun and sometimes a learning experience. Some type of meat grease seems to have a calming effect afterwards.

Anyway, the BBOD's are way off in value and their insulation resistance sucks wind. YMMV on other caps in the R-390/A. The 2MF oil filled paper & foil cap, C551, in the IF deck has never tested good on my cap analyzer. The insulation resistance is near zero! The blocking cap for the mechanical filters should be replaced. Old electrolytic caps should be replaced.

After those are taken care of; get the darned thing back together, alignment is next, work on bugs. In that order. Don't forget DeOxit on switches, etc.

Could be more, but you are making progress!

Date: Sat, 25 Oct 2014 08:15:20 -0400
From: Charles Steinmetz <csteinmetz@yandex.com>
Subject: Re: [R-390] Megger and Capacitor Measures ... Good vs. Bad ?

>...At room temp, all of these caps fall in the range of 4-6.2 (meg x uf)...

Some data points (everything below assumes that the capacitor is being measured at or below its DC voltage rating):

At 200v, an apparent leakage resistance of 100k represents a leakage current of 2mA. What kind of dielectric did the authors test at 47 uF? An ordinary aluminum electrolytic of that value (not even a low-leakage type), which should be the leakiest capacitor of that value you can find, is specified at around 250uA maximum leakage at room temperature (>35 megohm x uF). Any plastic film capacitor is specified for leakage much, much lower than that (for example, WIMA FKP3 metallized PP caps are specified at 500,000 megohms minimum, while Series 225 Orange Drops are specified at 25,000 megohm x uF product minimum -- 5,000 times

better than the spec you
quote). Typical ceramics are specified at ~10,000 megohms.

5 megohms x uF sounds awfully low to me, even for 1955. It's also *very* suspicious that caps made for tuned RF circuits (glass, mica, ceramic), which need very low leakage to deliver high Q, didn't score much higher than caps intended just to block or bypass DC (paper, plastic). I haven't read the study (do you have a link?), but I'm suspicious that there may have been systemic measurement errors.

In any case, it is my belief that a capacitor checker or megger is entirely unnecessary for working on tube radios. Indeed, I'd go so far as to say it's usually counterproductive because it is very often used way too early in the troubleshooting process and focuses the tech on individual parts when (s)he should be keeping an open mind and looking at the circuit as a whole.

Note that most of the suspect caps in tube radios are (i) the main filter capacitors (electrolytic in all but the oldest BAs) and (ii) paper bypass caps on power supply lines and tube cathodes. Bad bypass caps can almost always be found easily with a VTVM, since there are invariably decoupling resistors between the raw power bus and the bypass caps -- leaky caps will cause the local B+ at each bad cap to be low. (If the radio no longer works (blows fuses or smokes), then any leaky B+ bypass caps can easily be found with an
ohmmeter when the radio is unplugged -- they will generally read less than 1k to ground.)

Date: Sat, 25 Oct 2014 06:49:59 -0700
From: Alan Victor <amvictor@ncsu.edu>
Subject: Re: [R-390] Megger and Capacitor Measures ... Good vs. Bad ?

Thanks for the inputs and information. It was not my intention to bring a dead
horse back to life. In any case, I agree Charles on the troubleshooting technique you raise, while Craig raises a good point as well. However, if I find an issue with a circuit and circuit theory points to the likelyhood its this cap, I
would like to test it after removal with some level of confidence. If the measure
says it's OK, as Craig highlighted, put a new cap in its place anyway. However, I know I have NOT found the problem.

Charles, on the numbers, I believe I mis-interpreted the plot scale. The y-axis in this paper reads LOG MEGOHMS-MICROFARD PRODUCT. As all the caps investigated in this work had leakage R values in the 10^{10} to 10^{15}

ohm range, my error. So the plot figure 9 y-axis values are probably 10^4 to 10^6 (MEG-OHM x MF) in range. They reported mica and ceramic at 10^4, paper at 10^5 and the plastic polystyrene etc... in the 10^5 to 10^6 range. No, they did not measure large electrolytics.

There C values for measurement were 1000pF through .033uF. Applied V at
200volts. So the 47 uF I mentioned earlier should be ~ 85 M-ohms. Need to revisit what the megger is reporting. Incidently, a diode should be placed in series off the megger to the C under test. If you can't crank the generator with any constant rate, the C discharge back through the megger makes it hard to get a good reading. Charles, I am not in love with the megger, but seems like a reasonable tool for the job. If a cap is really bad, a simple VOM can pick it out. Its this borderline cases and the units that measure A-OK on an RX bridge that are potentially questionable.

The paper and plots were not found on line, but through a local libray search. It was published in '55 in the IRE Transactions.

Date: Sat, 25 Oct 2014 09:56:05 -0400
From: Charles Steinmetz <csteinmetz@yandex.com>
Subject: Re: [R-390] Megger and Capacitor Measures ... Good vs. Bad ?

Coincidentally, I just ran across some new product announcements from 1955 that give some leakage specs for capacitors of the day ("Tele-Tech and Electronic Industries," July 1955 p.82):

1,000 megohm x uF (for one manufacturer's paper and mylar caps)
1,000,000 megohm x uF (for one manufacturer's polystyrene caps)
10,000 megohms, minimum (for one manufacturer's ceramic caps)

All of these are way above the ~5 megohm x uF as cited from the Diamond Ordnance article.

Date: Sat, 25 Oct 2014 11:11:13 -0400
From: Ron Bussiere via R-390 <r-390@mailman.qth.net>
Subject: [R-390] Let me take a few whacks at that 'ole horse.

I restore boatanchor radios and test equipment for 'fun'. If you want to be well equipped for capacitor work, you 'might' need 3 different tools:

1. a tester like the TO-6A (I have a bunch of that series). This is necessary to test coupling/bypass caps for leakage at their rated voltage. ie: .01uf/600V or .1uf/600v
2. a bridge or a little hand held that will indicate value easily. A very leaky

BBOD will usually indicate their exact rated capacitance with a small 9VDC tester. So, what are they good for? Measuring unknown caps like old variables, etc.
3. a ESR meter for checking electrolytics

Although I have a bunch of very competent cap meters like the Spragues, my go-to (leakage) tester on my main bench, is just a HVDC supply and an old VTVM. This was first described to me years ago by Dr. Jerry, the Technical Advisor for the Collins Collector Assn. Works perfect. And almost as simple as me!! ha ha Once I get a bucket full of BBODs I chuck them. Now, I wished I'd saved them and put them on ePay!!!

Date: Sat, 25 Oct 2014 13:43:13 -0500
From: Tisha Hayes <tisha.hayes@gmail.com>
Subject: [R-390] Capacitor testing

I had lucked out on picking up a Sencore LC53 a bunch of years ago. It still had the original accessories pouch and test leads attached to the handle. That model is really nice as you can do ESR/Capacitance/Inductance/ringing (Q) tests at up to 600 volts. If you find one in an unknown but complete condition pick it up. One of the biggest mistakes people made is that they try to use any old test cable for attaching to capacitors and the unit will not zero out. The lead capacitance does not let them, they think it is broken and want to get rid of it.

Date: Sat, 25 Oct 2014 16:39:47 -0700
From: Perry Sandeen via R-390 <r-390@mailman.qth.net>
Subject: [R-390] Megger and Capacitor Measuring

I agree with Charles that using a megger is generally not a good way to trouble shoot a radio. It is cumbersome and uses up an enormous amount to time. Taking one end out of the circuit risks parts breakage or re-soldering problems. The true value of a megger would be in checking new caps for a potential

My position is if one is working on radio like the *A* or a SP 600 the most time and cost effective way is a whole sale replacement of all capacitors EXCEPT some silver mica?s. (The new type, not the old *postage stamp* units.

I do this because if one , two or five out of 50 BBOD's check OK, how much longer than their current 50 + years are thy going to last? And generally speaking the new caps are smaller sized. <snip>

Date: Mon, 3 Nov 2014 08:25:08 -0800

From: Bill Guyger via R-390 <r-390@mailman.qth.net>
Subject: [R-390] More on orange Drops

After the chain of e-mails a week or so ago about OD's and Mouser dropping them I began to look around. Allied still is stocking them and shows a much better selection of the 715P versions than Mouser shows in their catalog, but on their website a fair number of values are tagged "Not Available for Order".

Antique Electronic Supply has the 716P series in stock which Sprague says are the high performance version of the 715P's and the fact that they are flatter in cross section means they will fit into tight spaces easier like the IF Module.

I don't know if the fact that two major suppliers may.....I assume.....(which is dangerous) be dropping the line by selling off what they have on the shelf and not restocking. Or that Vishay Sprague may be phasing them out.....again hypothesizing..... is a portent of the world passing by us over the hill types that still love electronic thingies that operate on other than +5 , +12, +/-12, +/-15 V.D.C., etc. or operate off a wall wart and don't have a GUI.

OK I'm being sarcastic / tongue in cheek, going through the Mouser and Allied catalogs you still can find high voltage caps and even Carbon Composition Resistors so?????

In any event I bought a complete set of 716P caps from Antique Radio Supply for the 390A I'm fixing to start on.

Date: Sat, 29 Nov 2014 21:50:43 -0800
From: Dennis Wade <sacramento.cyclist@gmail.com>
Subject: Re: [R-390] RF Deck B+ short (390A)

..... <snip> What threw me was it was a cap I replaces about 10 yrs ago when I selectively recapped it. Didn't expect a newer part to go. So now to button it up and make sure it doesn't blow fuses anymore. As far as I can tell, there's no reason I can't power up the receiver with the panel dropped? I want to be able to apply power with as little reassembly as I can get away with just in case. Thank you all for the advice. It helped a lot.

Date: Sun, 30 Nov 2014 10:41:55 -0500
From: Bob Camp <kb8tq@n1k.org>
Subject: Re: [R-390] RF Deck B+ short (390A)

This is why I cringe a bit when people decide to wholesale re-cap some of

these radios. The parts in there have made it past infant mortality and various instal / damage issues. You are trading one set of things for another.

Now, indeed there are some sets that simply will drive you nuts until you find every last horrible cap in them. By now those are pretty well identified in each of the various radios. Those, yes you replace. It's shotguning everything in sight that worries me.

Date: Sun, 30 Nov 2014 09:45:24 -0600
From: Cecil <chacuff@cableone.net>
Subject: Re: [R-390] RF Deck B+ short (390A)

I guess it all depends on your perspective Bill and your skill level. I've done several and I would never say any of them have been in poorer condition than when I started....if your skill level is such that your finished work is poorer than when you started then you should take up a different hobby.

Few of these radios are museum pieces, the best we can do with them is make them sing by doing electrical restoration work that will put them in the best possible working condition we can and then enjoying them.

And yes while I had it apart I would definitely check all the tubes and many of the resistors....all of which can be checked easily without removal in most cases. (resistors) The problem with checking caps in many cases is you have to lift one end and by the time you do that it's just about as easy to go ahead and lift both ends and replace the thing. (I test at rated voltage with an LC-77)

I would also be curious what brand, type and rating the failed cap was.... Sounds crazy to have a replacement fail in 10 years.

One final comment...I'm not a shotgun tech...never have been...but when a component type shows a pattern failure and is known to be a problem I do use a blanket approach to its replacement....that's not shotgun sir..

Case in point...I would never suggest one blanket replace the type paper caps in the R-390/urr....historical data does not indicate it because quality parts were used to start with. It's your radio, do with it as you please but in the case of the paper caps...if it's an R-390A..I do know....they will fail and sooner than later...

Date: Sun, 30 Nov 2014 10:31:36 -0600
From: Cecil <chacuff@cableone.net>
Subject: Re: [R-390] RF Deck B+ short (390A)

Let me clarify a bit...

My suggestion was to replace all 50's vintage black or brown plastic tubular paper coupling and bypass caps. These have a long history of electrical leakage and shorting failures. I make this same recommendation for the Hammarlund SP-600 series receivers. Hammarlund realized the shortcomings of these caps and switched to ceramics in some JX specs.

I wasn't suggesting wholesale replacement of all capacitors...just the papers that have proven themselves to have a much higher than normal failure rate and only in the "A" model receiver. If these receivers had been built with the metal cased glass sealed caps of the R-390/URR we wouldn't be having this conversation.

You can of course just replace the caps that go shorted or go leaky enough to couple DC on the grid of the next stage and cause serious performance issues that you finally notice and rock on. But you might also incur collateral damage from this method in the form of burnt resistors, recurring premature tube failures, damaged inductors...etc. Not to mention unnecessary electrical load on the power supply from the cumulative leakage of yet to be discovered paper caps failing slowly as they do..

That method certainly continues the aura of the use of "vintage tube" gear...occasional failures, whisps of smoke now and then, those wonderful odors of stuff being hot...besides just tubes...

And that's OK....it's a personal choice...

Mine is to rid the radio of what history has proven to be a weakness...

One is not anymore right or wrong than the other.

It's your mission, should you decide to accept it, to consider the facts and decide what method aligns best with your abilities and personality.

This message will self destruct in 30 seconds....

Date: Sun, 30 Nov 2014 11:44:13 -0500
From: Bob Camp <kb8tq@n1k.org>
Subject: Re: [R-390] RF Deck B+ short (390A)

We're saying the same thing. It's the radios that you see with not one original part in them that worry me. On some radios (tube era Racal) that

might make sense. On a 390 - not so much. I still see pictures of them here and there.

Date: Sun, 30 Nov 2014 10:48:47 -0600
From: Cecil <chacuff@cableone.net>
Subject: Re: [R-390] paper capacitors

What's strange to me is that if we were having this discussion on a Hammarlund, Hallicrafters or National list it's pretty much an accepted fact that one of the first things one would do in a restoration would be to replace the paper coupling/bypass caps...black beauties, brown beauties, tiny chiefs you name it. But we continue to debate the issue as it relates to the "A" series of the R-390 receiver when in truth the paper caps used in its build are of only marginal if any improvement over those used in consumer grade communications receivers of the same period.

It's even accepted that all the Hunts brand coupling/bypass caps in the military Racal RA-17 series have to go due to electrical leakage issues....(ask me how I know) What makes the R-390A special (read exempt)?

Date: Sun, 30 Nov 2014 11:01:39 -0600
From: Cecil <chacuff@cableone.net>
Subject: Re: [R-390] RF Deck B+ short (390A)

Agreed... The Racal RA-17 has some of the worst resistors I have ever seen in a military grade receiver...the exception are some of the C-12 variants with US tubes which seemed to use decent quality US resistors.

Date: Sun, 30 Nov 2014 16:00:14 -0600
From: Cecil <chacuff@cableone.net>
Subject: Re: [R-390] paper capacitors

I'm not a proponent of that. There are some documented cases where silver migration in some of the silver micas has caused a problem but those are great examples of fix them when they fail and don't disturb those that are still working fine. That philosophy works here because they fail so infrequently and wholesale replacement of those will most definitely upset many things in the receiver. Full alignment being necessary....and again once some aging takes place. Best to leave those alone unless you have no choice.

Do replace the ugly tantalum and the filter caps...both good suggestions for a restoration....maybe even the AGC cap...

Date: Sun, 30 Nov 2014 17:08:24 -0500

From: Roger Ruszkowski <flowertime01@wmconnect.com>
Subject: Re: [R-390] paper capacitors

It's not just the paper caps that people are replacing. "Re-capping" the radio
seems to extend to every single cap anywhere and everywhere inside the box.

You are right. Other than the beauties and that acid dripping one of a kind cap in the audio deck, or the electrolytic multi section power supply filter caps,
the rest of the caps are just fine.

First we scare all the new comers with the C553 1st IF stage blocking cap and the mechanical filters then: I think folks see the mess under the electrolytic in the audio deck. Or find a brown beauty that is cracked. Or have the big power supply electrolytics leaking and think every thing is suspect.

And just think every thing needs rework and replacement as part of the maintenance needed to get a neglected receiver back into good operating condition. I hate to touch the first RF stage but it has a filter cap that should be changed and I replace it with the same value. I am not about to try and re-engineer the stage. So many of the silver mica caps and the trimmer caps are doing just fine as is. There is no reason to re cap a working VFO.

I ask: has any one done one of these full re caps and gotten more than 30 to 1 signal to noise ratio from the IF and audio deck with 150 micro volts in?
Has any one done one of these full re caps and gotten more than 20 to 1 signal to noise ratio from the full receiver end to end with 4 micro volts in?

Are there benefits to be gained from the effort beyond the cosmetic looks of the under side of the deck?

Today we read that a cap only lasted 10 years. How can we claim that a full recap will give us assurance that we will not be troubleshooting and repairing failed parts sooner than if we had not done a full recap?

Date: Sun, 30 Nov 2014 16:08:32 -0600
From: Cecil <chacuff@cableone.net>
Subject: Re: [R-390] R390 RF Cap Confessions

I suspect that's why every ceramic bypass and coupling cap in the SP-600

is the same exact value...not a design spec but supply chain efficiency.

Date: Sun, 30 Nov 2014 16:25:18 -0600
From: Tisha Hayes <tisha.hayes@gmail.com>
Subject: Re: [R-390] Paper Caps and the shield of invulnerability surrounding the R-390A

Cecil, you are right. There does appear we are all in a bit of denial about certain aspects of the R-390A receiver. I think that sometimes we half-believe that our radio was the last one that rolled off the manufacturing line at EAC in 1968 or was some special build that happened in the 1970's. We conveniently forget that even a 1968 vintage radio probably was built with parts that were made in 1964 and are 50 years old.

Hats off to the manufacturing of those radios in that day. It was the pinnacle of tube technology and was already rapidly being supplanted by transistors and early hybrid integrated circuits (in 1968).

Still, I have radios that were made in 2000 that have jinky capacitors.There is not a Motorola Spectra out there that does not have four or five of the capacitors of death in the audio circuitry. Resistors that have been following me around in that old coffee tin from 1992 do not always test like they should and I have ended up back at the same utility where I installed a comms system in 1988 that is now just wore out and only good enough for the junk collector.

That is a real kick in your mortality, when you are my age and replacing stuff I did when I first started out in engineering. Then I look ahead and realize that I might be replacing the work I am doing today in another fifteen years. Some of you guys are old enough to remember when the "nuvistor" was innovative.

We should never get too attached to the build quality or the components of what we have right now. The world continues to move on, we just like to preserve certain parts of it a bit longer. Capacitors are cheap when the possibility exists of you cooking a power supply choke or filters that are not so easy to find replacements for.

Date: Sun, 30 Nov 2014 17:31:29 -0500
From: Roger Ruszkowski <flowertime01@wmconnect.com>
Subject: Re: [R-390] R390 RF Cap Confessions

>I suspect that's why every ceramic bypass and coupling cap in the SP-600 is >the same exact value...not a design spec but supply chain efficiency.

Consider also the assembly process.

You could set a new person down at a station and start them off.
You get an assembly that looks like this.
You need to install N of these one type parts.
Your finished assembly needs to look like this.
Do not send your two reference assemblies down the line.

Once their solder skills and speed get up to par, you could move them over a station and let them do other parts. You betcha, logistics trumps design every time. I see what you want but this is what you are going to get from what is standard stock. Only after our common value substitutes do not work will we go back to your original value. Old designers will just call for stock values and wait for the prototype to be tested. If some thing needs to be adjusted from a stock value then they can claim: hey, a stock value did not work in the prototype.

Date: Sun, 30 Nov 2014 16:39:22 -0600
From: Cecil <chacuff@cableone.net>
Subject: Re: [R-390] R390 RF Cap Confessions

Yep...I agree. The trick is what are better values for those since we are now replacing them during our restoration.

Date: Sun, 30 Nov 2014 19:35:11 -0500
From: Roger Ruszkowski <flowertime01@wmconnect.com>
Subject: Re: [R-390] R390 RF Cap Confessions

>The trick is what are better values for those since we are now replacing them
>during our restoration.

I do not have a pat answer.
It is an engineering problem.
I say with a straight face let's ask Tisha.

Power supply filter caps can never be to big.
But you need to watch the inrush current at power on.

You can suck to much current and after power on the inline current limiting resistors just waste usable power as heat so there is a curve some where and likely a nice mathematical formula that establishes a line that should not be crossed as you get bigger in filter caps.

Bypass caps, I do not know why but higher working voltage looks to do a better job of filtering with less random popping noise. More capacitance does a better job of filtering.

Coupling / DC blocking caps can get higher in value but you open up the bandwidth as well as noise along the way.

Some times you are looking for an impedance match so you can not just change the cap value as you upset the filter characteristic or power transfer.

There is an overall noise floor. As long as the stage you are in is not the critical
stage that sets the signal to noise ratio you can allow more noise through a coupling cap.

But you start changing stage gain and that may not be adjustable. AGC starts to not track changes in signal level. Strong signals get really reduced more than needed so signal fade is not well regulated by the AGC as expected.

But as those by pass caps off a B+ line after a plate resistor go up in value you
expect more of the signal from the stage that makes it across the resistor to get bypassed. The filter cap stores a bit more charge and you get a bit stiffer B+ for the stage. Small changes to be sure. Screen grid and cathode bypass caps likewise may help the stage if there values are increased.

First I see higher voltage rated caps as being less noisy and then larger value caps as being less noisy. I see noise in two forms. The high speed low level hiss and the low speed pop spike. I think the larger value and higher voltage caps have less low speed pop and because we are holding the cap at a larger charge value there is less noise.

Consider pouring a cup of water in a 1/2 full one gallon can and a 1/2 full one quart can. You can pour the water into either can. But you just get less splashing as you pour that one cup into the two quarts as when you pour the same one cup into the pint in the one quart can. I just see less splashing/noise in the analogy.

We know there is a whole set of caps that when installed in the audio deck of the R390A do wonders to improve the audio band width and thus fidelity of the audio. OK for AM and lost on the ditty effort.

I think we are stuck with a cut-and-try approach. You have to work from back end to front end as the back end may mask stuff up front. And when you get to the back end it may all suddenly blow up as changes get unmasked.

I think you have to have a goal in mind to guide you:

What is the expected end results.
I want more RF sensitivity.
I want a better signal to noise ratio,
I want more audio level.
I want more audio fidelity.
I want to damp the perceived ringing from the mechanical filters.
I want to reduce the power hum in the audio output.
I want to alter the AGC time constants.
I want to alter the AGC response.

With a goal you can then determine the usual suspects.
Then you can begin to question the usual suspects.
You can apply change to a part and gauge the before and after behavior.

Keep the good changes and restore that which does not yield improvement in the direction you are trying to go. Cap values are a good three credit graduate level class in electronic engineering. Three pages later I add nothing useful to the conversation. I have no good sound fast rules to tell you what will work.

I think the ARRL values used in their projects are reasonable. These projects are driven by good design practice and not limited by logistic procurement or parts counts. Did I get three cents in here?

Date: Sun, 30 Nov 2014 19:49:00 -0600
From: Cecil <chacuff@cableone.net>
Subject: Re: [R-390] R390 RF Cap Confessions

Wouldn't it be great if we had original engineering design documents prior to going through the bean counting grinder... Great response Roger... I'll continue to stick to factory values on the 390...may play with some values on the SP-600.

Date: Sun, 30 Nov 2014 18:38:10 -0800
From: Dennis Wade <sacramento.cyclist@gmail.com>
Subject: Re: [R-390] RF Deck B+ short (390A)

As it turned out, R205 was toasted as a result of the shorted cap. Someone
asked what brand it was...I can't tell. Its a small green rectangular device. Dave (SK now, used to put together cap kits) would put the parts with their call out numbers in plastic bags.

A couple of list members suggested that I do an entire recap on this unit. Cecil later modified his recommendation to just the bypass paper caps.

That's what I did back in 2003 or so...replaced the black beauties that were in there (not many) and called it good.

When I replace a part, I make a decision about how I'm going to do that based on how little collateral damage I can inflict given my abilities to work in tight spaces. So, in replacing R205 I'm going to remove the corpse leaving as much of the leads as I can, then wrapping the new part's leads around the stubs. (I can almost hear some of you shudder :)) In my view its far more important to get in and out with as little disturbance as possible. The *last* thing I want to happen is to break off a post or some other nightmare while doing a simple cap or resistor replacement. Think of it as a tactical decision. Given that philosophy, I'm not going in to replace every cap and resistor "just because" it might go bad later. Someone suggested that another list member "find another hobby" if the radio wouldn't be better after a wholesale parts replacement. That is absurd in my view. Not everyone has the same skill set or needs to live up to a particular standard. OK, this is more than I've said in years. LOL. Take care everyone.

Date: Mon, 1 Dec 2014 10:26:24 -0600
From: Cecil <chacuff@cableone.net>
Subject: Re: [R-390] RF Deck B+ short (390A)

That's worrisome...how many radios out there now have the green chiclet caps in them... I had heard Dave was a great guy but never bought from

him...mainly because I had been buying from another list member who was putting together cap kits and SS hardware kits. I'm needing more now...time to go hunting...

Date: Mon, 1 Dec 2014 09:00:10 -0800
From: "Roger Gates" <w7kvt@wvi.com>
Subject: [R-390] green caps

That is interesting about the green caps. My Capehart came with virtually all green caps and I haven't had any fail yet. The radio was built in 1961 and has been operating 24/7 for many months now.

Date: Mon, 1 Dec 2014 11:14:36 -0600
From: Cecil <chacuff@cableone.net>
Subject: Re: [R-390] green caps

The color thing gets a bit confusing.... Are they square or rectangular also or tubular. I'm guessing greenish colored tubular paper caps.

Date: Mon, 1 Dec 2014 09:36:38 -0800
From: "Roger Gates" <w7kvt@wvi.com>
Subject: [R-390] green caps

The caps that I was refering to are all rectangular mica types in and around the frequency determining ckts and the mechanical filters. The paper caps are mostly Vitamin Q types and some yellow tubular ones that I have pretty well replaced. I was surprised to find the green ones as I have never run across those before. I was expecting the terrible red ones or black beauties!!

Date: Mon, 1 Dec 2014 10:00:02 -0800
From: "Craig Heaton" <hamfish@efn.org>
Subject: Re: [R-390] green caps

Here in Springtucky, Orygun; The question is should a post-mortem be performed on the green chicklet cap? Is it a film/foil maybe a metalized film cap? Please raise your hand if in favor of an autopsy! Only one hand please, no fair raising both hands.

Date: Mon, 1 Dec 2014 10:34:33 -0800
From: Dennis Wade <sacramento.cyclist@gmail.com>
Subject: Re: [R-390] green caps

Green chiclet is a good description, specifically small green rectangular cap. I will try and take a pic and post tonight for those interested.

Date: Mon, 1 Dec 2014 10:58:34 -0800
From: "Roger Gates" <w7kvt@wvi.com>
Subject: [R-390] green caps

The green caps in my Capehart are Micamold CM15,s and are in the pf range. Not paper bypass or coupling caps. It sounds like there are some green paper caps out there. More info would be great.

Date: Mon, 1 Dec 2014 14:28:13 -0500
From: "KR4HV" <kr4hv@numail.org>
Subject: Re: [R-390] green caps

Google 0.22uf 400v mylar capacitor.. There are lots of values of green "chiclet" type "mylar" coupling caps with various voltage rating on the market.. Some have polyester, etc. RS even sells some of the lower voltage ones. I once rebuilt a Henry 3KA RF amp where someone had taken out the mica grid to chassis RF coupling caps and put in nice big ODs.!!!! Might someone have used some of the above "mylars"?? Just a thought.

Date: Mon, 1 Dec 2014 11:44:48 -0800
From: "Roger Gates" <w7kvt@wvi.com>
Subject: [R-390] green caps

Thanks for that info Walt. Most of the ones I have purchased are white or pale yellow, but I can see that the new ones are probably fine.

Date: Mon, 1 Dec 2014 14:48:28 -0500 (EST)
From: Barry <n4buq@knology.net>
Subject: Re: [R-390] green caps

Now that I think about it a bit more, I'm not sure the samples Dave sent to me were green. They may have been more of a orange-brown color. They were still "chiclet" shaped, though. I'll have to dig out that bag and check.

Date: Mon, 1 Dec 2014 20:03:34 +0000 (UTC)
From: Bill Guyger via R-390 <r-390@mailman.qth.net>
Subject: Re: [R-390] green caps

I'm pretty sure the green caps that are being discussed are Mylar types that are OK for audio circuits etc. but not up to Orange Drop "standards". They can be used in a pinch, but OD's are much to be preferred.

Date: Mon, 01 Dec 2014 14:47:44 -0500
From: Charles Steinmetz <csteinmetz@yandex.com>
Subject: Re: [R-390] green caps

When someone says, "green chiclet capacitor," these are what I think of:
ebay item 320794002127

Is that what we're talking about? The ones I've opened were metallized polyester caps. '50s and '60s transistor radios, and the low-level sections of '60s and '70s stereo gear from Japan, are absolutely full of them. I don't believe I've ever seen one that pretended to be rated for more than 100v, but there may be some. I certainly wouldn't trust them in tube equipment, regardless of the claimed voltage rating.

Date: Mon, 1 Dec 2014 12:23:47 -0800
From: Dennis Wade <sacramento.cyclist@gmail.com>
Subject: Re: [R-390] green caps

Well as far as the picture goes...and that's not very far...it looks similar. I'll just have to take a pic with the markings and post it later.

Date: Mon, 1 Dec 2014 18:14:10 -0500
From: "billriches" <bill.riches@verizon.net>
Subject: Re: [R-390] green caps

I have not had any problems with the green Mm CM15 caps in the RF cans. The red ones have been quite rough - mostly in the Stewart Warner rigs - they
change capacitance lower - sometimes 1/2 the stated value. Change them all as they can be intermittent!

Date: Thu, 4 Dec 2014 04:19:11 +0000 (UTC)
From: Perry Sandeen via R-390 <r-390@mailman.qth.net>
Subject: [R-390] Capacitor Chicanery

As we all now the Chicoms do cheat on anything manufactured. Where this affects us. Orange Drop is a registered trade mark of Sprague. But they made a big mistake. They did not copyright or trademark the color. Big mistake. Now out of Canada caps called *Orange Dip* are being sold. With the same color as the Sprague units and an almost identical name. Buyers probably think they are getting the original *Drop* at a very favorable price. I don’t know if these caps are good, bad, indifferent, or of varying quality from batch to batch.

My two issues are that this is clearly a knockoff; stealing the name of a good product. This usuallymeans there is a quality problem. My other issue is that the seller doesn't make this difference known. This is shame as people have spoken well of their products and business. If these caps were the equivalent of the Spragues, they could use a different name, color and tout they were as good, but cheaper.

Date: Wed, 3 Dec 2014 21:31:36 -0800
From: "Drew P. via R-390" <r-390@mailman.qth.net>
Subject: Re: [R-390] RF Deck B+ short (390A)

[snipped] "I wasn't suggesting wholesale replacement of all capacitors...just the papers that have proven themselves to have a much higher than normal failure rate and only in the "A" model receiver. If these receivers had been built with the metal cased glass sealed caps of the R-390/URR we wouldn't be having this conversation."

The "filter killer" cap (C-553) in the R-390A is of the same type as the metal cased glass sealed caps of the R-390/URR (aka "Vitamin Q"). Is there something special about the R-390/URR which precludes the possibility of these caps failing? Is there something special about the R-390A which causes rampant failures of these caps? Perhaps it is Murphy's Law, given the value and unobtanium status of the R-390A's mechanical filters.

Date: Thu, 04 Dec 2014 02:49:41 -0500
From: Charles Steinmetz <csteinmetz@yandex.com>
Subject: Re: [R-390] RF Deck B+ short (390A)

>The "filter killer" cap (C-553) in the R-390A.....

The reason for replacing C-553 is not that they are especially failure-prone (at least not in my experience, which extends to a couple hundred 390As). It is that they have been known to fail (though very rarely), and a failure is very costly -- normally at least one mechanical filter (and often all of them, as the owner
systematically tries each one while trying to diagnose the deaf radio). Replacing it with a nice, fresh, 600v film-and-foil is just good insurance.

Date: Thu, 04 Dec 2014 03:29:48 -0500
From: Charles Steinmetz <csteinmetz@yandex.com>
Subject: Re: [R-390] Capacitor Chicanery

>Orange Drop is a registered trade mark of Sprague.

Actually, the "Orange Drop" trademark belongs to SBE, the manufacturer of Orange Drop capacitors:

Date: Sun, 26 Apr 2015 21:38:21 -0400
From: Roy Morgan <k1lky68@gmail.com>
Subject: Re: [R-390] To Reman or not?

> ... multiple failures of the SM caps in the "A". ...

Do compare prices at justradios.com
These folks - are in Canada, - have good parts- have good prices
- are very good to deal with- ship promptly to US addresses

and also offer schematics, electrolytics, capacitors and resistors of all sorts, and assortments.

Date: Tue, 20 Sep 2016 18:55:52 -0400
From: <wb3fau55@neo.rr.com>
Subject: [R-390] source for replacement capacitors

Some of the small value caps, as found in the RF deck are available from a MFGR called AVX. They have 1.5pf and others. I would like to find a source for these caps.

Date: Sun, 9 Oct 2016 23:27:59 -0500
From: Chuck Collins <chuckcollins@prodigy.net>
Subject: [R-390] killer cap and mica in RF

Plodding along on the 10 year owned R390-a restoration that has been ignored way too long. Which is the killer cap I hear about and which mica fails most often in the under 8mhz RF

Date: Mon, 10 Oct 2016 12:44:00 -0400
From: Guido Santacana <gsantacanav@gmail.com>
Subject: Re: [R-390] R-390a audio hum

Check the tantalum cap and multisection electrolytics in the audio deck. The problem may be probably in one of these if they are the originals.

Date: Mon, 10 Oct 2016 13:03:27 -0400
From: Guido Santacana <gsantacanav@gmail.com>
Subject: Re: [R-390] killer cap and mica in RF

The killer cap is C553 under the IF deck. Now, about the mica cap that causes failure under 8MHz I want to know too. Replace all .1 and .033uF bumblebee caps under the IF and RF sections. Those are probably gone by now. The main multisection electrolytics in the audio deck may reform but be careful and also check the tantalum cap under the audio deck. The best thing is to replace it with an electrolytic. C551 is the big 2uF cap mounted on top of the IF deck. It is a usual failure item and can be replaced with a new smaller one installed under the chassis. I just went through resuscitating an EAC unit that spent more than 30 years in storage. Hope this helps.

Date: Mon, 10 Oct 2016 13:10:05 -0500
From: Chuck Collins <chuckcollins@prodigy.net>
Subject: [R-390] killer and mica caps

Thanks! I'd hate to be done and have a new problem on the horizon.
I have read (can't remember where) that one certain mica is a common failure on the under 8 mhz problem. -Chuck

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Date: Mon, 10 Oct 2016 14:31:46 -0400 (EDT)
From: Barry <n4buq@knology.net>
Subject: Re: [R-390] killer and mica caps

Chuck Rippel used to have an active site that I think listed that cap in the RF deck. I think it was 100 pf (or so) across one of the transformers but I can't recall the exact values now. I think it was killing the output of one of the mixers but just can't recall for sure. You might find that with Google.

Date: Mon, 10 Oct 2016 14:46:47 -0400 (EDT)
From: Barry <n4buq@knology.net>
Subject: Re: [R-390] killer and mica caps

See this page:
http://www.antiqueradios.com/forums/viewtopic.phpt=5475

Date: Mon, 10 Oct 2016 15:00:09 -0400
From: "Don Heywood" <wc4g@knology.net>
Subject: [R-390] killer and mica caps

The below is a link to Chuck's old site. 73, Don WC4G
https://web.archive.org/web/20090204020515/http://www.r390a.com/

Date: Mon, 10 Oct 2016 14:44:49 -0500
From: Chuck Collins <chuckcollins@prodigy.net>
Subject: [R-390] Killer caps

Thanks everyone. The mica I saw referenced had to be the one across the transformer primary. I changed that out a while back. No difference. Changed it again and now at least I have 17 mhz @ 3 volts across transformer secondary and faint signals coming in.
I was hoping there might be another culprit. Will replace C553 and dig further into RF deck as time allows. -Chuck

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Date: Mon, 10 Oct 2016 16:30:07 -0400
From: "Bill Riches" <bill.riches@verizon.net>
Subject: Re: [R-390] killer and mica caps

C327 100 pf mica across T207.

Date: Mon, 10 Oct 2016 23:47:57 +0000 (UTC)
From: Larry H <dinlarh@att.net>
Subject: Re: [R-390] killer and mica caps

Chuck, There is a good type and poor type of C553 replacement - common manufacturing methods are 'film and foil' and 'metalized foil' (these are sometimes referred to as 'foil' caps and usually have a 'self healing' property). The problem is that when a 'self healing' event occurs, an arc has occurred internally. This arc (very high current pulse) may destroy the filters we are trying to protect.

Use a 'film and foil' type of cap and be safer. An example of some are SBE 715P orange drops, but any high quality 'film and foil' type will work. It should be 500v or higher.

Date: Mon, 10 Oct 2016 19:21:49 -0500
From: kc9ieq <kc9ieq@yahoo.com>
Subject: Re: [R-390] killer and mica caps

Conversely, if a film/foil cap shorts, it stays that way and will DEFINITELY take out the filter. I've contemplated placing a very small value ceramic or mica cap in series as an added safety measure. Thoughts

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Date: Mon, 10 Oct 2016 19:24:30 -0500
From: kc9ieq <kc9ieq@yahoo.com>
Subject: Re: [R-390] killer and mica caps

Edit, I meant metalized film, not film/foil.

Date: Tue, 11 Oct 2016 01:13:12 +0000 (UTC)
From: Larry H <dinlarh@att.net>
Subject: Re: [R-390] killer and mica caps

Hi Chris, I understand all of our desires to get this right, as i've had to replace bad filters, and it's no fun or cheap, and sometimes a crap shoot (is my replacement good).

Here's some things to consider:

1. Any coupling capacitor introduces distortion into the signal path. How much is acceptable is the question.

2. Adding another cap in series doubles the distortion, and doubles the required capacitance for each one.

3. If I use 2 caps in series, how often will I need to test both to maintain the desired level of safety Monthly Weekly Daily

4. All capacitors fail eventually. What is the desired and acceptable life for C553 and can I obtain that quality of cap

5. Once a self healing event occurs in a metalized film cap, can it be determined that one did occur No, and once they start, they reoccur at a quicker frequency.

6. The life expectancy of the best quality film and foil is much higher than a metalized film given they are rated at the same voltage and temperature.

7. Should I test the replacement cap under its rated voltage YES! This is the safest way to be sure it will last. If a new cap is bad, it will show up here.

I personally believe that a 630 v SBE 715P (or related) orange drop is the best and 2 in series would not improve the safety factor very much at all and not enough to require weekly checking or endure the increased distortion.

Date: Mon, 10 Oct 2016 21:32:56 -0400
From: "Jacques Fortin" <jacques.f@videotron.ca>
Subject: Re: [R-390] killer and mica caps

I have seen so many film/foil caps that gone short in hi-end tube amplifiers (taking one of the output tubes and the HV fuse to hell at the same time) that I cannot tell them better or more immune to "discharge" incidents than self-healing metallised film caps. In fact they are worse.

All capacitors may suffer from a short between plates, and I tend to trust more the ones of vintage manufacture than the recently manufactured ones. If basic care (clean room condition) is not taken when the capacitor plates are wound, airborne dust can came trapped in the winding. With constant pressure and time, any single dust particle can pierce the dielectric and start a breakdown event. This will cause a permanent failure in most film/foil types, and a self-healing effect in a metallised film one.

Remember that, for a metallized foil cap, most of the current involved in fusing the metallization layer(s) come from the capacitor charge itself and usually causes only a small voltage variation across.

This is very unlikely that the voltage across the cap can go to zero (then

applying full B+ voltage to the input coil of the R-390A mechanical filter, as discussed here at the beginning) before the few atoms thick metallisation layer gives up and clear the short (a self-healing event last typically 10nS, so not enough time to fuse the coil winding either).

>From experience, metalized foil types are safer than the film/foil types. Still afraid about the failure probability OK: let's go take a look at stacked metalized foil+foil types (Vishay/Siemens) or at floating-electrode types (WIMA MKP10, FKP1).

Or... take any good metalized film cap and using a hi-pot or leakage tester, apply two times it's maximum working voltage across for a full minute: if this will not clear any pending "self-healing" event, nothing will do, right Just my 2 cents worth anyways...

Date: Mon, 10 Oct 2016 20:52:09 -0500
From: Francesco Ledda <frledda@att.net>
Subject: Re: [R-390] killer and mica caps

Given the small bandwidth of the IF, the frequency/gain variation created by the cap is negligible.

Date: Mon, 10 Oct 2016 19:40:31 -0700
From: Renee K6FSB <k6fsb.1@gmail.com>
Subject: Re: [R-390] killer and mica caps

I am beginning to think that a fuse in series with the cap on the filter side might be the answer . just a thought .....

Date: Mon, 10 Oct 2016 23:45:32 -0400
From: "Jacques Fortin" <jacques.f@videotron.ca>
Subject: Re: [R-390] killer and mica caps

I'm sorry but... some have to find a fuse that can blow fast enough to protect the R-390A mechanical filter(s) input winding, and this is not an easy task. It's like trying to protect a transistor with a fuse: usually, the transistor will blow first to protect the fuse... I prefer to rely on a very good capacitor there (such as a WIMA MKP10 10nF, 5%, 630V). And if ever the very worst happen, there is a way to rewound the input coil, right

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Date: Tue, 11 Oct 2016 03:53:05 +0000 (UTC)
From: Larry H <dinlarh@att.net>
Subject: Re: [R-390] killer and mica caps

Sorry Renée, There are no fuses that I know of that would open before the filter would be damaged. Chris, no need to hide, this is a good learning

tool.

I also wanted to define what I meant by test the cap before installing. Apply the rated voltage (not higher than) and look for leakage with a sensitive amp meter (around 50 micro amps full scale) in series with a 10k ohm resistor. If there is any current flowing at all, do not use it for C553.

As for measuring the distortion, in this situation, you would need to be able to measure the IMD of the IF unit. This takes special equipment, but in any case, this is a sensitive cap for minimizing IMD.

Clearing 'self healing' event possibilities can not be done today, as was pointed out, they normally occur because of contamination (and other issues) in the manufacturing process, and it takes a varying amount of time for insulation penetration/breakdown to occur. However, you could test them as the manufacture does, with a recording scope monitoring for current spikes while measuring for leakage for an extended time. If you apply twice the rated voltage and you see no leakage, that does not mean that an event will not occur in a few months or a couple years.

I am all for finding a longer life cap for C553. Does anyone know of any tests done by independent testers I'm not too keen on believing this kind of data provided by a manufacturer.

Date: Mon, 10 Oct 2016 22:59:47 -0500
From: Chuck Collins <chuckcollins@prodigy.net>
Subject: [R-390] killer caps

Thanks all for the info. I'll get this one going soon. (After 10 years now) I traded my first 390 for a Icom R-1. Oops! This 390 I got at an auction. I raised my hand and ignored everything around me until I owned it.

Date: Tue, 11 Oct 2016 02:22:38 -0400
From: Charles Steinmetz <csteinmetz@yandex.com>
Subject: Re: [R-390] killer and mica caps

>I am all for finding a longer life cap for C553. Does anyone know of any tests >done by independent testers

I have tested hundreds of capacitor types for both performance and reliability, many for extended periods. Any large, reputable capacitor manufacturer's 600v film-and-foil types will outlive you and the next four or five owners of your radio. Just install them and you will never have to give capacitor reliability another thought.

I'm particularly fond of the SBE Orange Drop film-and-foil caps (Types 225P, 418P, and 715P) and can vouch for them without hesitation. The 715Ps use polypropylene film, which makes more ideal capacitors than polyester (which is used in the 225Ps and 718Ps) -- but the 715Ps are larger, value for value. I've used all three in radios, and have never been able to hear or measure any difference in performance.

Note that others are marketing *metallized film* caps with an orange epoxy coating, and calling them "Orange Dips" and the like, in an attempt to trade on the good reputation of SBE Orange Drops. Do not be misled! Conversely, Sprague, CDE, and Vishay have all, over the years, marketed SBE Orange Drops, so you will find genuine ODs marked with those brand names (and the same SBE Type numbers, 225P, 418P, and 715P).

Finally, stay away from the audiophile capacitor brands -- most of those are made by small manufacturers that shouldn't really be making capacitors, and the failure rates can be shockingly high.

Date: Tue, 11 Oct 2016 16:57:21 -0400
From: "Lester Veenstra" <m0ycm@veenstras.com>
Subject: Re: [R-390] killer and mica caps

The filter is the fuze

Date: Tue, 11 Oct 2016 18:51:08 -0400
From: Charles Steinmetz <csteinmetz@yandex.com>
Subject: Re: [R-390] killer and mica caps

I have had a number of off-list inquiries asking which capacitor manufacturers are "large and reputable." I mentioned specifically the SBE Orange Drops, and the Orange Drops supplied by Sprague, Vishay, and Cornell Dubilier/CDE. In addition to these, other large, reputable capacitor manufacturers include:

Sprague, Vishay, Cornell Dubilier/CDE, AVX, EPCOS, Wima, Wurth, Roederstein, and Panasonic. (Illinois Capacitor is reasonably large, but IMO does not make very reliable film capacitors.)

I do not know whether all of these manufacturers make film-and-foil capacitors -- you will have to look at the datasheets to find out.

Date: Tue, 11 Oct 2016 18:38:02 -0500
From: kc9ieq <kc9ieq@yahoo.com>
Subject: Re: [R-390] killer and mica caps

How about ASC film caps I just learned and verified that one at least one value of both the X675 series and X363 series are indeed made in the USA.
It's unfortunate that the Orange Drops are now exclusively made overseas.

Date: Tue, 11 Oct 2016 21:25:53 -0400
From: Charles Steinmetz <csteinmetz@yandex.com>
Subject: Re: [R-390] killer and mica caps

All of the ASC "Xyyy" Series caps are metallized film, not film and foil. The X363 Series only goes up to 400v. The X675 Series comprises specialized high voltage caps (2kV and up), which have some design tradeoffs that we don't need to accept in applications below 1kV. I would not recommend either for tube radio or audio erquipment.

ASC does make some film and foil types in both polypropylene and polyester, for example the 368, 321, 621, 668, 663, 663F, and 621 Series. From what I have seen, these may be worth considering -- but ASC is not really a "large" capacitor manufacturer, so that would need to be proven over time.

> It's unfortunate that the Orange Drops are now exclusively made overseas.

I'm not sure that is true, and even if it is, I'm not sure that it has negative implications.

Here's the history of the Orange Drop line: Sprague started making the basic design in a factory in Vermont where they were developed for use in bomb and missile fuses during WW2, and adopted the trade name "Orange
Drop" for the line in the late 1950s. In 1985, Sprague sold the OD line, including the production facilities, to SBE. SBE continued to manufacture ODs in that same factory until it sold the line to CDE in 2012. CDE continued to produce them in that same factory, but said at the time that it planned to move production to other CDE facilities.

That change has probably been made by now, but I have not heard whether
OD production moved to facilities in the US or overseas. So far, all of the CDE "Country of Origin" slips I have seen say "USA," and distributors still list CoO as "USA." There has been lots of uninformed chatter on the web claiming that CDE ODs are now made in Mexico and/or China, but I have seen no evidence of that as recently as this summer.

Furthermore, factories all over the world are fully capable of equalling and even bettering the quality of US-made capacitors. It all depends on what the management does. It is entirely possible that ODs are being made today on the very same machinery that the factory in Vermont was using. It is also possible that they are being made in a brand-new, state-of-the-art factory where tolerances and materials are held to much tighter tolerances than in the VT factory. In either case, that facility may be in the US, or it may be in Mexico,
or India, or China. It probably makes no difference in the quality of the capacitors, and could even mean that quality has improved.

Date: Tue, 11 Oct 2016 21:48:29 -0400
From: Bob Camp <kb8tq@n1k.org>
Subject: Re: [R-390] killer and mica caps

If you have ever visited a film and foil plant, its pretty basic. The advances in equipment have more to do with speed of manufacture than anything else. To the extent there is a secret sauce its in paying attention to the quality of your raw material. For the last two decades at least, that a function of buy it from the right guy rather than in-house testing. There are certainly a number of errors you can make as they go down the line, its rare to see them show up in purchased product.

You might ask: But what about tight tolerances Well, they do them by squeezing the cap before it is epoxy coated. There is a fast aging process after than to take out he strain. Once upon a time it was some really good gal doing pushing on the part and watching the C meter. Those days are long gone, there is a squeeze machine these days. For the really tight stuff they age it for a few
months and then re-sort. That's never been a cheap process ..

Date: Tue, 11 Oct 2016 22:05:01 -0500
From: kc9ieq <kc9ieq@yahoo.com>
Subject: Re: [R-390] killer and mica caps

I only became aware of the film ASC caps because of a Hallicrafters 506 television project, which has some 6000V rated coupling and filter capacitors. The deflection coupling capacitors are a whopping .03uF@6000V, which pretty much leaves film caps as the only option. I'm interested to learn more about this company, it would be nice if more vendors stocked their products though. Pretty sparse, at least for the HV offerings I've looked at so far.

My desire for US manufactured caps is not necessarily due to fear of inferior quality imports, I just like to buy from a US company if given the option and the item is not priced completely out of the market. This is of

course assuming that two theoretical items/options are of equal quality. Liken it to supporting a local storefront by purchasing an item there, that you could get at Walmart or on Amazon. I'll gladly pay 15% more for a small item A) For the convenience, B) To support and hopefully help keep that local store in business. My .02.

Before CDE bought the OD like from SBE, some OD caps were already being manufactured in China or Taiwan, I forget which. This came directly from the lady I spoke with at CDE, probably 6-8 years ago. If I recall, it was some of the more popular/higher volume sellers which were moved to this offshore plant.I just assumed that CDE moved the remainder of the Barre, VT manufacturing to an overseas plant, but in hindsight this may be a poor assumption. I haven't bought any OD caps from the man vendors in a year or two, I may check on CoO tomorrow out of sheer curiously.

In either event, quality of the raw materials and conditions/handling are a valid concern. I've wondered about this when it comes to fresh production Sprague TVA series electrolytics, and the new multi-section can caps sold by CE Distribution-- Reportedly built on the old Mallory tooling.

Date: Wed, 12 Oct 2016 01:55:08 -0400
From: Charles Steinmetz <csteinmetz@yandex.com>
Subject: Re: [R-390] killer and mica caps

> paying attention to the quality of your raw material.

Three equally important factors are the handling of materials (how even and constant are the film and foil tensions, etc.), the design of the winding and terminations (there are still patented winding plans, termination methods, and production processes to this day), and the cleanliness maintained throughout the production process.

Date: Wed, 12 Oct 2016 06:43:28 -0400
From: Bob Camp <kb8tq@n1k.org>
Subject: Re: [R-390] killer and mica caps

The winding plan and the termination stuff gets designed into the machine (yes theres probably one machine running around the plant). That pretty much puts it outside the day to day control of the people running the gear or running the
plant. Either they designed / bought the right gear or they did not.

Cleanliness matters in juts about all electronics. Unless things have changed a lot since my last visit, semiconductor wafer grade clean rooms are not part of a normal film capacitor plant. Its more the same level as

living room clean.
Yes, you can get it wrong, its not a massive challenge to get right.

So, again on the same basis as the original post (management controls the process), this is not quite the same thing as making a lot of modern components..

Date: Wed, 12 Oct 2016 08:03:09 -0500
From: Tisha Hayes <tisha.hayes@gmail.com>
Subject: Re: [R-390] killer and mica caps

Never has so much concern been given over one solitary capacitor, just replace it and be done with the discussion. If the same amount of attention went in to the thousand or so other components on the radio then this forum will go on for the next 500 years.

There are components that are much more problematic, yet we do not even
discuss them. With the abundance of crystals in the radio it is more challenging to find a replacement in the same package size. Another challenge is the debate over carbon comp, carbon film or metal film resistors in the RF/IF chain and how self inductance changes a tuned circuit.

If you lose a transformer then it is all-over, done-for; yet we do not discuss how to protect a transformer from overcurrent (B+ fusing) or inrush current limiting.

Date: Wed, 12 Oct 2016 17:56:05 -0400
From: Bob Camp <kb8tq@n1k.org>
Subject: Re: [R-390] killer and mica caps

I find it absolutely amazing just how robust the transformers in these radios are. There are other pieces of gear that would have them at the top of the failure list.

Date: Sat, 15 Oct 2016 21:14:45 +0200
From: Holzer <jackholzer@swissmail.org>
Subject: Re: [R-390] killer and mica caps

I like the AVX glass dielectric capacitors....and if your R390 gets irradiated this cap will survive. (radiation hardened spec)

Date: Sun, 16 Oct 2016 04:58:37 +0000 (UTC)
From: Perry Sandeen <sandeenpa@yahoo.com>
Subject: [R-390] Filter blocking capacitor

I agree with Tisha. Paraphrasing Churchill, never has so much been written, by so many about a few.

Expanding. The original cap lasted about 50 years. What do you expect Igor, get the wooden stake and some garlic. Orange Drops are not deity. They are good caps BUT not mandatory! A good Vishey .01/1KV is all that's needed. It is rated 400 volts above almost all film-foil or vapor deposited capacitors.
Charles is absolutely correct. Buy from Mouser or others the con brothers. Nichicon, United Chemcon, Rubicon. I buy the 10Khr/105C caps for my use. Also Panasonic caps are great also but theyhave a more limited offering of the 10Khr/105c units. If you nickel and dime on your receiver, sooner or later you will destroy some unobtanium or very, very expensive coil(s). I don't mean to be harsh but this hobby takes some reasonable dinaro. I'm fortunate to have a large chunk of change invested in older HP equipment as I'm interested in proving that the numbers I get are real and can cross check my data. One doesn't need that to keep your receiver(s) running, But you can't use a URM 25 or Heathkit, Eico, B&K or other (relatively) inexpensive test equipment to prove you have world class numbers AND THAT'S OK.

We just have to be realistic. It's a hobby, not a life and death issue.

Date: Sun, 16 Oct 2016 05:33:34 +0000 (UTC)
From: Perry Sandeen <sandeenpa@yahoo.com>
Subject: [R-390] Capacitor leakage testing

If you want to test your high voltage capacitors for leakage there are a couple on ways to do it. One is to buy a Sprague TO-6 or similar that will apply the rated voltage to the caps and measure leakage. A much, much older way is to use a HV supply and a 11 megohm vtvm. One end of the cap goes to the B+ and the other to the input lead to the vtvm and the vtvm ground goes to the poer supply ground. Using Ohms law of 11 megs and the B+ value and read the dc vtvm scale to calculate leakage. NOTE. After testing your capacitor make sure to keep both leads shorted for a 10 or more minutes as the *memory* voltage can give you a nasty shock the next day. Found that out the hard way.

Date: Sun, 16 Oct 2016 10:03:20 -0400
From: Blair Batty <blairbatty@gmail.com>
Subject: Re: [R-390] Filter blocking capacitor

Thank you all, for your advice. I'm going to Mouser; I won't cheap-out.

Besides restoring my R-390, I collect and restoring old HP test gear, old

radios and the occasional modern electronics. I've been picking up parts (of dubious providence) as I need them, from the local electronics/surplus store. But I want to buy a kit of electrolytic caps from Mouser, so I'll have trustworthy caps in stock.

My problem now is an embarrassment of riches at Mouser. There are too many
choices available. I just want an assortment of radial and co-axial electrolytics, in a range of voltages and values. I already have an assortment of orange drops, etc; electrolytic is may need. But Mouser has dozens of kits... If anyone can help me choose the kit(s) I want, or narrow my search, I'd be grateful.

Date: Sun, 16 Oct 2016 11:03:00 -0400
From: Dan Martin <pitfit@comcast.net>
Subject: Re: [R-390] Filter blocking capacitor

I like the source below. Friendly people and several cap kits at real radio glow in the dark values and voltages. http://www.justradios.com/

Date: Sun, 16 Oct 2016 18:40:21 -0400
From: "Bill Riches" <bill.riches@verizon.net>
Subject: [R-390] C327 checks

Checking out an R390a that had low intermittent sensitivity below 8 mhz.
Replaced C327 and sensitivity came up to less than 1 uv. Checking osc output at J221 as measured with 10 db probe and Tek 465 is now 28 vpp. Before changing C327 voltage varied between 5 to 15 vpp.

Checked out cap with a Sencore Z meter. Cap would change between 35 - 70
pf. Checked for leakage - 200 volts - no leakage however capacity read 105
pf after being zapped. A day later cap was varing as before. Zapped it again and 103 pf. Then sprayed freeze-spray on it and it went bad again. I
think the cap is faulty!

Date: Mon, 17 Oct 2016 19:38:13 +0000
From: David Wise <David_Wise@Phoenix.com>
Subject: Re: [R-390] killer and mica caps

I've used the LND150 N-channel depletion-mode MOSFET as a current limiter before. It's darn handy - and almost the only one of its kind. It can block 500V, Idss is a couple mA, and it's very fast.

The impedance seen by the filter and its trim cap is the parallel combination of pentode V501's plate resistance and choke L505's impedance. Both are high, so the additional kilohm or so of Rds(on) is insignificant.

The filter input coil is low-resistance, so tacking a diode across will not save it.
The R648/URR works around the problem by elevating the filter input coil to B+. I don't like it.

Date: Mon, 17 Oct 2016 22:01:42 +0000 (UTC)
From: Perry Sandeen <sandeenpa@yahoo.com>
Subject: [R-390] Free Capacitors (almost)

For anyone who would like to replace the *KILLER CAP* with a .01/KV Vishey. I purchased new, factory sealed in bulk from Mouse over 500. If you will send me a SASE letter sized envelope, I will send you FREE up to 5 Vishey caps.
The postage for one or two would be one first class stamp. ?3 or more one should attach 3 first class stamps.

Mail to: Perry Sandeen 661 La Costa Dr. Banning, CA 92220-5317.

Your anonymity will be sacredly guarded to avoid you getting any unpleasantness from the kindly Orange Drop Deluded Believers Society. Any customs or import duty ?or surtaxes are the sole responsibility of the purchaser<G>.

Date: Wed, 2 Nov 2016 16:22:20 +0000
From: David Wise <David_Wise@Phoenix.com>
Subject: Re: [R-390] killer and mica caps

A while ago I proposed the Supertex LND150 depletion-mode high-voltage MOSFET to protect the filters. It occurred to me that under some circumstances, RF signal current into the filter might be enough to cause pinch-off, so I checked. I'm happy to say it's fine.

Details: I don't actually have an LND150 installed. Neither did I connect a current probe - I didn't feel like removing the IF deck. Instead, I measured the impedance and voltage. I used an HP 400 wideband AC voltmeter, with a calibrated 10x attenuator probe to minimize capacitance. I put the probe on V501's plate. I measured impedance with the radio off, using a generator and series resistor and adjusting the resistor so the voltage at the filter input was half the generator output. My 8kHz filter input impedance is 20-30K in a broad frequency band centered on 455kHz, but

tuning carefully, I detected one sharp notch on one skirt. At the very bottom, the impedance fell to 5K. I assume the other filters are similar. The R-390A IF signal chain is designed so that loud signals make the final stage, V504, overload first, so that the fall in cathode current will make the CARRIER meter read upscale to give the operator a straightforward overload indication in MGC mode. I decided that if the LND150 didn't interfere with this, it was okay.

Now I turned on the radio and measured V501's RF plate voltage with signal applied at the antenna jack. With the radio in MGC mode with RF GAIN at maximum, I applied just enough signal to overload V504. V501 had about 0.5V of RF. At 5K impedance, this is 0.1mA rms, 3dB above one tenth of the LND150's guaranteed minimum Idss. Therefore, worst-case, the LND150 has 17dB of headroom before tripping. As RF GAIN is reduced, more input is needed to overload the deck. I repeated the experiment at several settings. It turns out that worst case is RF GAIN about 7. At that point, it takes 1.0V (6dB more than 0.5V) at V501 to overload V504. So the LND150 has 11dB of guaranteed worst-case? headroom. This was at the point of overload. When I turned my generator to maximum, filter input rose to 10V. Therefore, it may be possible for a signal to make the LND150 limit, but only well after V504 is already limiting. Finally, I switched to AGC mode just to see what the filter input is under normal operation. It was hard to measure due to LF noise swamping the meter, but I believe it's 10mV or less.

Date: Tue, 14 Aug 2018 18:47:00 +0000 (UTC)
From: Fred Stillwell <fred.s43@frontier.com>
Subject: [R-390] C-103 cap replacement

Good afternoon all, what is a suitable replacement for: C103, 10 mfd. 300vdc oil filled cap. B+ line, in the R-390/URR. This is the big round grey cap mounted on the chassis near the front. In the R-390-A, C103, 50 mfd. @ 50vdc oil filled bath tub style, on the cathode bias line. I have several R-390/URR's with the original oil filled caps and two R-390-A's that have damaged C-103 caps. I'm thinking electrolytic in both cases. Any ideas
Thanks and 73's FredAA8S

Date: Tue, 14 Aug 2018 16:22:20 -0400
From: Roger Ruszkowski <flowertime01@wmconnect.com>
Subject: Re: [R-390] C-103 cap replacement

Today any good 10 - 20 mfd. 300 450 - 600 VDC.The C103 can be re stuffed like the R390A fellows are doing to the R390A plug in caps. Some other nice cap can could be used for a package.

Hang an electrolytic can on a surface mount clamp base.

a 300 volt of better 10Mfd total cap or better.
Wire the new cap in.
How you do it becomes an craft project.
How you do it reflects on your soul.
Easy fix as new parts are smaller.

Date: Tue, 14 Aug 2018 17:27:18 -0400
From: Bob Weiss <bobweiss1967@gmail.com>
Subject: Re: [R-390] C-103 cap replacement

For the 390A, I generally open up the "bathtub" capacitor by first drilling a 2 small holes in the underside. Leave one open for a pressure vent, and thread a wood screw or sheet metal screw into the other for a handle. Clamp the can in a vise,and unsolder the bottom cover with a propane torch, while pulling the cover loose with a pair of pliers on the installed screw.
>
The old guts will pull out of the metal can pretty easily, and a new 47uF/50V cap can be installed inside the can. The terminal lugs have hollow grommets in them which can be uncovered by melting the existing solder, and then threading the new cap leads through and resoldering.

You can reinstall the bottom of the can by tack soldering it back if desired, but it is completely invisible when the cap is reinstalled in the chassis, and can be left off if desired.

I use a similar technique to restuff C551, the 2 uF AGC cap on the IF deck. Those are usually a bit messier, though, as they are oil or wax impregnated, rather than dry electrolytics. The same technique also works to open up the RFI filters, to replace the caps with smaller values for GFCI compatibility. I use .01 uf X1Y2 rated ceramics here, rather than the 0.1 uf papers originally used.

Date: Wed, 15 Aug 2018 02:20:27 -0400
From: Roger Ruszkowski <flowertime01@wmconnect.com>
Subject: Re: [R-390] C-103 replacement

C103 was before the invention of hazardous oils. The oil fill in R390 originals is mineral oil. OK and still safe after all these years. The ratio of core heat in the cap and the surface area required to meet cooling needs when the room temp was over 110 resulted in oil filled caps. C103 has its own closed fluid cooling system half a century ahead of CPU coolers.

New technology has made much of this stuff a moot point. We do not even think of operations temperatures for B+ filter caps these days. More C is better at C103. You get a trade between how hard the cap pulls its inrush

current. The rectifier tubes have current limits. The 10 MFD was as big as possible with out over loading the rectifiers at power on surge.

New parts new internal parameters. Solid state the rectifiers with some robust diodes and add some more C to C103. Less B+ ripple and a bit less receiver noise floor. A DB here and there and soon your receiver is no longer the choke point in you minimum discernible signal.

Date: Wed, 15 Aug 2018 09:14:42 -0400
From: Roy Morgan <k1lky68@gmail.com>
Subject: Re: [R-390] C-103 cap replacement

I suggest you ONLY replace that oil filled cap if, BOTH:- the thing is leaking oil.....And..- you are actually worried about the oil. That sort of oil filled cap rarely fails.

Date: Wed, 15 Aug 2018 02:20:27 -0400
From: Roger Ruszkowski <flowertime01@wmconnect.com>
Subject: Re: [R-390] C-103 replacement

C103 was before the invention of hazardous oils. The oil fill in R390 originals is mineral oil. OK and still safe after all these years. The ratio of core heat in the cap and the surface area required to meet cooling needs when the room temp was over 110 resulted in oil filled caps. C103 has its own closed fluid cooling system half a century ahead of CPU coolers.

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New parts new internal parameters. Solid state the rectifiers with some robust diodes and add some more C to C103. Less B+ ripple and a bit less receiver noise floor. A dB here and there and soon your receiver is no longer the choke point in you minimum discernible signal.

Date: Wed, 27 Feb 2019 17:56:07 +0000 (UTC)
From: Perry Sandeen <sandeenpa@yahoo.com>
Subject: [R-390] Testing mica and HV caps

>You pretty much need to test even the new or NOSmica caps. .....
>that were brand-new-bad.

OK, Good idea. How did you do it? Most capacitance meters now are low voltage units. I do have an old Sprague TO - 6 that does do a HV test but it

in on that to-do-to-get-it-operating list.

Date: Wed, 27 Feb 2019 14:52:07 -0500
From: Bob kb8tq <kb8tq@n1k.org>
Subject: Re: [R-390] Testing mica and HV caps

You can do a pretty good job with a HV supply, a series resistor, and a DVM. If the cap will hold voltage for a few minutes, it's probably good. (= they fail as a short and only open up if you don't have the current limiting resistor). For RF caps, a resistor in the megaohm range will still charge them up quick. It is unlikely that you will blow one wide open at < 1 ma.

Date: Wed, 27 Feb 2019 15:52:47 -0500
From: "Jacques Fortin" <jacques.f@videotron.ca>
Subject: Re: [R-390] Testing mica and HV caps

The series resistor can be the DVM itself (10M ohms resistance on DC ranges is a common value). Adjust the HV supply to the DCWV of the capacitor to be tested for leakage, then connect the DVM in series with the capacitor across the HV supply output. If the DVM reading do not goes to zero, you have a leaky capacitor: 1uA of leakage equals to a 10 volts reading, for example: if the DVM reading "balances" to zero after a time (C in uF x 50 seconds), there is no measurable leakage to be concerned with (all the modern capacitors behaves like this). Do not forget to discharge the capacitor after testing.... If it is leaky, it will discharge itself !

I also made a HV supply for that purpose with a small 700Vct HV transformer. It provides up to +500 / -500 Vdc when the primary is driven by a Variac. So caps can be tested up to 1kV DC. 500k ohms resistor in series with each + and - output prevent suicidal accidents (limit the output current at 1mA). The HV filtering uses just 1uF, 600V caps in each leg. This is just to test leakage, however. Testing value and ESR requires something else...

Date: Thu, 28 Feb 2019 05:18:59 +0000 (UTC)
From: Perry Sandeen <sandeenpa@yahoo.com>
Subject: [R-390] Mica capacitors and tempco

All the previous posts about capacitor tempco was most interesting but is irrelevant for our B/A receivers. Here's why. We generally operate our receivers in a comfortable environment of say, 70 to 78 degrees F. Although some might operate in a somewhat cooler basement its temperature will remain fairly constant. As the receiver warms up it will eventually reach some stable elevated temperature. This elevated temperature will be where we do our alignment. Although this final

temperature may be a few degrees more or less from set to set or location to location there will not be any practical variance requiring some tempco value. We just align to spec and call it good.

Date: Fri, 1 Mar 2019 15:23:06 -0600
From: Richard <prof1705@cableone.net>
Subject: Re: [R-390] Testing mica and HV caps

I just had a thought. I have a Tektronix 576 Curve Tracer (itself a boatanchor) that can source 1,500 volts. A integrated circuit with gate oxide leakage has a very characteristic breakdown curve so I assume a discrete leaky capacitor should also. I think I'll give that a try next time I find some older caps to compare.

Date: Wed, 17 Apr 2019 04:48:48 +0000 (UTC)
From: Perry Sandeen <sandeenpa@yahoo.com>
Subject: [R-390] Mica caps

>Sometimes the 200pf mica cap in the transformers goes south. I had one >and they're abugger to find.

Well here's the bad news. It's only going to get worse. The A's are getting old enough to qualify for Social Security. Longevity WAS NOT an OEM requirement. Also the mica caps were not made or sped'd to the EIA value series that has been used for many years. If you want to keep your A running with the least amount of effort heed my voice crying in the wilderness. Go to Dan's Small Parts. There you can buy SM caps starting at 1pF and going up in usually 1pF to 3pF increments into 33pF and beyond. They are $.69 each. You can then pad a value to what you need. He also sells 2 different assortments of 50 assorted caps with 15 different values for $15.00. This is the easy way by far. The hard way is to go to Mouser/Dgi-key/Newark/Allied and pay $5 or more dollars each and then hope it's going to work. Even if you go the hard way and get lucky, the same problem is going to arise again someday and probably sooner than you thinks as these mica caps are now starting to fail at a much higher rate than before. This is just the cost of doing business with an A.
And if you want to save yourself future grief, if you haven't already, download the Almost Ultimate R390A ski tiff from the R390FAQ site, take it to Kinko's and get a large copy made.Why Because when I drew it I earmarked all the problem parts noted on the reflector list for years. Your going to need it sooner or later. And a Chuck Rippel pointed out, in some cases the teflon covered wiring capacitance had to be taken into account.

Date: Thu, 25 Jul 2019 19:36:04 +0000 (UTC)
From: Perry Sandeen <sandeenpa@yahoo.com>

Subject: [R-390] R-390A Conversion Oscillator Low output

Sometimes one can spend large amounts of time trouble shooting a circuit to no avail as everything seems to check out OK IF all the voltages check out and connections have been re-checked for mechanical integrity it might be a good time to *Shotgun* the circuit by just replacing all the components in the vicinity. This is not a substitute for good trouble shooting. If practical having a friend review what you've done and the *Oh my goodness* moment arrives where one finds something, perhaps obvious that was overlooked. And it's embarrassing. But we've all done it and it's just a fact of life, so we try to shrug it off (sometimes with difficulty) but we've learned a valuable lessen (hopefully). That all said, with a radio whose OEM parts qualify for Social Security, The *shotgun* method is not unreasonable. There have been times in the past where I've done it and the problem is solved. Yet each part tested OK. You end up scratching your head and look for a cold 807.

With OEM parts this old although they test OK with the test equipment we have, just fail somehow in the active circuit and we'll never know what it is. Because of the large amount of capacitors that have proven to be problems as noted on the Almost Ultimate R390A schematic, I'm an advocate of replacing all the caps, including micas as it not a matter of if, but when.

I also advocate replacing all the carbon comps with 1% metal films which aren't all that expensive if one shops around as there are many used of the same value.

I'm not advocating that you take a perfectly good A that meets all its specs and take it apart.It is when you have ongoing repair problems, or the receiver just can't make specs no matter how you swap or replace tubes, then this is a good sign that a reman is a good idea.

Now if you do this, ONLY do one section of module at a time. For if one was to make two or three errors doing the replacement you could go nuts trying to find the errors. As signals go back and forth to the modules, an error that shows up in one module is really in another.

Additionally if you do this slowly over a time span its far less stressful and the chances of errors greatly diminish. I've found this out more than once on the late Friday or Saturday nite at zero dark thirty in the AM where it was *just one more* whatever? Lost sleep, got up late the next day not refreshed and generally had a lousy day.

Now some receives are going to need it sooner than later as some were used without good cooling care. So it becomes some what of a crap shoot

to when to reman, but it always will come.

Date: Tue, 18 Feb 2020 03:12:23 +0000 (UTC)
From: Perry Sandeen <sandeenpa@yahoo.com>
Subject: [R-390] Postage stamp mica caps and AGG problems

Postage stamp and sometimes dog bone caps continue to fail. The maddening thing is they will check OK on the relatively simple capacitor checkers most of us have. Apparently microscopic *fingers* migrating through the insulation causes this effect. AGC problems have been noted over the years with the OEM paper caps having leakage. I annotated all the problem caps mentioned over the years on the R390A ski's I drew. If you take them to Kinko's or a FedEx shipping office, they can print them for you on their large printers for about $8 each. (There are two sheets.) so you can have prints that are about 18 X 36 inches. I believe the TIFF files are available on the R390FAQ site. If not and some one wants them just email me off list. I also have an extensively modded SP 600 ski, that's an upcoming project as well, that if anyone would like to have I can send that as well. The best place I've found for reasonably priced dipped silver mica's ($. 69 each)is Dan's Small Parts, however he is closed until March due to an injury. Just radios also carries them at $.99.

Date: Tue, 18 Feb 2020 06:28:01 -0600
From: Tisha Hayes <tisha.hayes@gmail.com>
Subject: Re: [R-390] Postage stamp mica caps and AGG problems

I have been seeing about a 25% capacitor-fail rate on NOS paper/wax when tested with a Secore LC75. Most of them will easily pass testing with a DVM-type tester that only puts a few (tens) of volts across the cap and doesn't do anything to measure ESR. While mica caps fail at a lower rate that has been observed as well.

Micas are weird; near rated voltage tests don't always show the problem, capacitance values look somewhat good, ESR.. didn't show anything; but in an RF test at a few hundred KHz they are no longer resonant when compared to control samples.

I try to test at least at 75% of rated voltage (up to 600 volts on 1KV caps) and failures sometimes happen with spectacular, fireworks type results. A few times the cap would wander around in value, up and down, seemingly in a random way as internal areas of the cap are changing characteristics.

I don't even mess with reforming any more; other than for curiosity's sake; I might be able to get a cap to not be as leaky but the recovery is temporary at best and the next time the cap goes on an excursion it

becomes a hard failure that takes out resistors, or with electrolytics in the power supply, a choke or transformer.

Date: Tue, 18 Feb 2020 19:35:12 +0000
From: David Wise <David_Wise@Phoenix.com>
Subject: Re: [R-390] Postage stamp mica caps and AGG problems

Thanks for posting your findings, Tisha.

Can you measure a few abnormal micas on a 1kHz impedance bridge? Is DF normal? (Most of these caps are so small that their ESR may not perturb DF much until you go RF.)

These days the only paper caps I expect to pass are brand-new XY line bypass, and hermetic-sealed. Everything else is shoot on sight, unless (a) I have a curatorial wish to preserve the instrument's history and (b) the cap is used where leakage is permitted and failure won't cause collateral damage. That's paper only; plastic film is trusted except for a few corner cases. I'm losing patience with old electrolytics, except for the premium ones. Parts I left in because they measured okay last year are failing now. Life's too short to mess with them twice.

Date: Wed, 19 Feb 2020 00:57:12 +0000
From: wb3fau55@neo.rr.com
Subject: Re: [R-390] R-390 Digest, Vol 190, Issue 10

Response to Ms. Hayes- electrolytic caps- 125 uf in Heath HP-23 supply. i was able to reform these caps using a Heath IP-28 cap tester which puts hi volts on cap being tested. After few minutes, they were fine. I think if unit is kept in use, they will be good. 73s Russ
---
Date: Sun, 29 Mar 2020 15:28:47 -0400
From: "Jacques Fortin" <jacques.f@videotron.ca>
Subject: [R-390] A question about silver-mica capacitors failures.

It was flagged by many contributors to this site that the number of silver mica capacitors failures is rising. As the failure mechanism seems to be understood (silver migration within the capacitor package), it is not clear for me if this occurs only when a potential difference is applied to these capacitors, or if it can be triggered only by the time, even if the radio containing those capacitors was left unpowered for years. I will appreciate to know your thoughts about it.

Date: Sun, 29 Mar 2020 18:27:41 -0700
From: Larry H <larry41gm@gmail.com>
Subject: Re: [R-390] A question about silver-mica capacitors failures.

Hi Jacques, From what I've read and experienced, both are a factor. An SM cap just sitting there with no voltage applied will eventually go bad. But, if it has DC voltage applied to it, the migration seems to occur quicker. What's interesting is that this does not mean that all SM caps with potential applied will fail before those that do not.

Date: Mon, 30 Mar 2020 01:37:12 +0000
From: David Olean <k1whs@metrocast.net>
Subject: Re: [R-390] A question about silver-mica capacitors failures.

Hello Jacques

It is hard for me to say, but I have looked at a few failures and the capacitors are fine at very low voltages, but die as the voltage is increased. I have one SM capacitor that is fine at 8 volts, but starts leaking when the potential approaches 12 volts p to p. I would think that elevated voltages would aggravate the situation. but I am seeing a small but equal number of failures from the R-392 with 28 volts DC on the plates vs. the R-390 or R-390A with about 200 volts. The usage of the two receivers can be quite different as well. R-392s were strictly tactical radios and were used infrequently, whereas R-390A s had both tactical and fixed station type environments where DC voltage was applied for months at a time. In my mind, the jury is still out! It would be nice to test a bunch of NOS postage stamp caps from the 50's.

Date: Mon, 30 Mar 2020 02:57:44 -0400
From: Charles Steinmetz <csteinmetz@yandex.com>
Subject: Re: [R-390] A question about silver-mica capacitors failures.

First, note that two common types of silver mica capacitors are found in boatanchor radios. First came molded mica capacitors, mostly seen as the "postage-stamp" type. As their name implies, a plastic body was molded over a naked capacitor assembly (generally, with leads arranged axially).

Then came the more modern dipped silver mica caps, overlapping in time with the molded plastic types. These used a similar internal capacitor assembly (usually with the leads arranged radially rather than axially), which was literally dipped into an epoxy encapsulant.

The notable difference between molded and dipped mica caps is that the dipped epoxy type has *much* better environmental sealing than the molded type. As we see below, this is a clue to the failure modes we experience.

The failure rates of mica capacitors are correlated directly with the environmental insults they have suffered during their lives. Water and moisture, in particular (but also atmospheric pollutants like gasses of sulfur and peroxides) seep into the innards of mica caps and cause silver migration and failure. So, we see a very high failure rate in mica caps that have spent time underwater (same with ceramic caps, BTW), and a lower but still considerable rate for mica and ceramic caps that have been stored in humid environments (i.e., the way surplus radios and capacitors are very often stored). Here, caps in unused radios and caps sitting on the shelf are *more* at risk than caps in radios that are at least occasionally used (the heat from operation tends to drive out the moisture).

In all cases (water, humidity, and atmospheric pollutants), the failure rates for dipped mica caps are quite substantially lower than for molded mica caps; but poor storage conditions of unused radios and caps on the shelf eventually get to them all, so failure rates of dipped mica caps are expected to increase in the coming decades (note that the dipped caps have a double advantage -- besides being better sealed, they are also generally somewhat newer than molded mica caps).

Date: Mon, 30 Mar 2020 17:35:30 +0000
From: David Wise <David_Wise@Phoenix.com>
Subject: Re: [R-390] A question about silver-mica capacitors failures.

Great summary, Charles. Do the dipped parts have a crimp joint between the lead and the assembly, like the molded ones?

(PS: I'm not used to thinking of bakelite as a plastic. It is, though, isn't it? Strictly speaking?)

First, note that two common types of silver mica capacitors are found in boatanchor radios. First came molded mica capacitors, mostly seen as the "postage-stamp" type. As their name implies, a plastic body was molded over a naked capacitor assembly (generally, with leads arranged axially).<snip>

Date: Tue, 31 Mar 2020 04:24:29 -0400
From: Charles Steinmetz <csteinmetz@yandex.com>
Subject: Re: [R-390] silver-mica capacitor failures

> Do the dipped parts have a crimp joint between the lead and the assembly, like the molded ones?

Generally, the ones I've seen the insides of are put together like multi-layer ceramic caps or stacked film capacitors -- stacks of

metalized dielectric sheets, every other sheet offset, with sprayed metalization at the two ends (connecting all even sheets and all odd sheets together), with radial lead wires attached by the metalization (often with metal end caps for structural reinforcement). I'm sure there are a variety of ways (and proprietary processes) it is done by different manufacturers.

> I'm not used to thinking of bakelite as a plastic.

The general usage of that term includes the various phenol/formaldehyde resin systems like Bakelite and Catalin. Bakelite itself used the trade name "Bakelite Plastics" for many years. What information do you have that the bodies of postage-stamp mica caps were made of it? The ones I've destroyed in the interests of science appeared to me to be some other plastic material.

Date: Tue, 31 Mar 2020 14:48:31 +0000
From: David Wise <David_Wise@Phoenix.com>
Subject: Re: [R-390] silver-mica capacitor failures

Thanks for describing dipped-mica construction. I don't know what the molded mica bodies are made of; I just guessed. It's hard and breaks with a grainy texture, which made me think of Bakelite. What do you think it is?

Date: Sat, 4 Apr 2020 15:54:01 -0400
From: Charles Steinmetz <csteinmetz@yandex.com>
Subject: Re: [R-390] silver-mica capacitor failures

> Thanks for describing dipped-mica construction. I don't know what the molded mica bodies are made of; I just guessed. It's hard and breaks with a grainy texture, which made me think of Bakelite. What do you think it is?

My best guess is some form of hard rubber (a.k.a. vulcanite, a.k.a. Ebonite). This family of materials yields quite a variety of physical characteristics, generally similar to Bakelite but somewhat-to-considerably less brittle.

Date: Mon, 5 Jul 2021 15:47:32 -0700
From: Larry H <larry41gm@gmail.com>
Subject: [R-390] Silver Mica capacitor failures

I'm hoping to put together a clearer picture of the SM cap failure rate and need your help. The R-390xs are packed full of SM caps, most of them in the RF deck and conversion oscillators (in R-390As, there are 99 there and 22 in the IF deck for a total of 121). What I thought would be interesting to know is what are the DC voltages applied to the SM caps in

As. So, here it is: high: 23, low: 27, and zero: 71. High voltage is between 150 and 200 volts, low voltage is AGC and bias around +10 to -20 VDC. Even if you haven't worked on one for a while, your input will be helpful - just let me know when the last time was. No research is necessary, just what you can recall. I'd like to know the year, # of R-390As worked on, # of SM caps you HAD to replace in each DC voltage category, and the symptoms. If you'd like to group years together, that is fine, but please keep it to a maximum of 5 years. If you didn't change any SM caps, say 'none'.

Example:
2001, 1 A, none
2005, 2 As, hi: 1, lo: 0, 0: 2, leaking: 1, changed value: 2
2011-2015, 9 As, hi: 2, lo: 4, 0: 9, changed Q: 3, leaking: 4, changed value: 7, shorted: 1
Last repair: 2015.

And one more thing, please - include how many As you have and how many are in use any amount of time. If you send me an email directly (larry41gm 'at' gmail 'dot' com), the info inside will not be divulged - just tabulated for a total. The totals I will publish. Thanks a lot for taking the time to do this. I hope you had a good July 4th, Independence Day.

Date: Sat, 2 Apr 2022 01:01:47 -0400
From: Roy Morgan <k1lky68@gmail.com>
Subject: Re: [R-390] Capacitor testing

Below is the whole of my Diatribe: capleakagetesting.txt. It tells about safe ways to test even very tiny leakages in caps. Electrolytic cap testing is covered in reform.txt

> On Mar 9, 2022, at 2:23 AM, Jim Whartenby via R-390 <r-390@mailman.qth.net> wrote:
>
> When doing any kind of leakage testing, you have to think about unintended consequences.
> If you plan to measure current by putting the VOM or VTVM in series with the DUT (IN CURRENT MODE) (Device Under Test) plus the power supply then if the DUT fails in a short, the power supply will force the maximum current that it is capable of supplying through the meter. That will do wonders to the pointer of the analog meter movement or the circuitry of a DMM. Not to mention heating up the DUT.
> You should limit the maximum current so as not to overstress either the DUT, the power supply or the test equipment. ?

Capleakagetesting.txt

From K1LKY

Capacitor leakage testing

This is my diatribe on testing capacitors for leakage. Other diatribes are:

- reform.txt about reforming electrolytic capacitors
- powercordsandbypassing.txt about safe use of line cords and line bypassingcapleakagetesting.txt about testing capacitors for leakage
- variacs.txt about the use and dangers of variacs
- (coming soon: linebucking.txt about reducing line voltages)

1) Find a B+ supply that will deliver a voltage as high or higher than the capacitors rated working value. A variable supply is nice but not necessary. Current capacity is not important - a few milliamperes is fine.

2) Get a VTVM or a DVM with high input impedance (10 megohms is common).

3) Set the voltmeter to measure volts on a range above the supply voltage. Connect the common terminal of the supply to the common terminal of the voltmeter.

4) With the supply off for safety, connect the capacitor from the high side of the supply to the high side of the voltmeter.

5) Turn on the supply.

6) Observe the meter.

The meters input resistance causes it to operate as very sensitive microammeter. A reading of 10 volts across 10 megohms indicates a current of one microampere. One volt, one tenth microampere, or 100 picoamperes.

You can do the equivalent of this test for coupling caps by removing the tube from the circuit and carefully measuring the voltage at the grid of the following stage.

Example: with a supply voltage of 350 volts and voltmeter indication of 50 volts, the capacitor is conducting a current of 5 microamperes. The capacitor has an impressed voltage of 300 volts (350 minus 50). You can figure the capacitor leakage resistance by Ohm's law, or by proportions. Figuring by proportions, it has 6 times the voltage as the voltmeter, so it has 6 times the resistance, or 60 megohms.

In my experience, it is common for old paper capacitors to indicate one

quarter to three quarters of the supply voltage in this setup. It is also common for modern film capacitors to indicate less than a few tenths of a volt.

Consider the case of an old paper .01 uF capacitor feeding the audio output tube in a receiver. The preceding stage operates at a plate voltage of 200 volts. The old paper capacitor leaks about 100 microamperes. The output tube grid resistor is 100 Kohms. The voltage developed across the grid resistor from the leakage is 10 volts. This 10 volts reduces the grid-cathode operating bias on the audio output tube from minus 14 volts to minus 4 volts. In the case of a 6V6, or 6AQ5, that will increase the standing plate current from a normal 25 or 30 ma to about 80 or 100 ma. The audio will sound terrible and the tube will last only a few hours instead of a few thousand hours. Leakage in the blocking cap at the audio pre-amp stage is even more damaging to the sound since the stage operates at lower bias levels. (Notes about BC-348's: 1) Some use the resistance of the filter choke in the negative B+ supply line to develop bias for the audio output tube. Connecting a home brewed plate supply directly to ground causes the output tube to run with out bias, resulting in terrible audio and a quickly worn-out tube. 2) Many BC-348's use flat, black, rectangular bypass caps that are not mica but are paper. They are almost invariably leaky or shorted.)

Consider the case of a screen bypass capacitor in a receiver IF stage. The B+ supply is 220 volts, normal screen current is 5 ma, screen resistor is 22K, and screen voltage is about 110 volts. The tube operates with normal gain. Now, if the screen bypass cap leaks 3 milliamps, the screen voltage will go down to something like 60 volts. The tube will operate a lower gain, will not respond in the same way to AGC voltage, and will be more subject to overload and distortion on strong signals. If many IF and RF stages are having similar screen bypass leakage problems, your radio will be quite dead. I have a number of as-yet un-re-capped receivers like this. Recently an un-restored SX-101A produced a faint pop and it's gain dropped dramatically. I suspect a shorted screen bypass cap.

You can measure screen bypass and grid coupling capacitors in circuit by pulling out one or more tubes and measuring voltages on either side of the cap. Take into account the voltmeter input resistance and any resistance to ground on the non-B+ side of the cap, such as the grid resistor. You can do this withOUT removing any modules from the chassis in the R-390A. Count your tube pin numbers in the correct direction (counter clockwise) when working from the top of the chassis. A little drawing to keep nearby can help you in this.

Note: Many older radios were measured with 1000 ohms-per-volt meters and the reported normal tube voltages reflect this. Most affected are

screen voltage and voltages in high resistance circuits. Notable examples are the TV-7 tube tester and most pre-war receivers. Your TV-7 will *not* be calibrated correctly if you do it with a modern 10-megohm input resistance meter. Just add a resistor in parallel with the meter appropriate to the scale you are using. (...Full scale volts times the "ohms per volt" of the meter they used.)

From: Henry van Cleef <vancleef@netcom.com>
Subject: Re: Reforming, Chapter CCXXVI
To: Old Tube Radios <boatanchors@theporch.com>
Date: Wed, 7 Jun 2000 22:22:37 -0600 (MDT)
Cc: boatanchors@theporch.com

Don, I don't think it makes much difference whether you do it a section at a time or multiple sections all together. Indeed, I think we sometimes may make too much of a process out of reforming old caps. Consider the Tek 530/540 scope. These are chock full of Mallory FP's (don't think Tek used any other in these), and have a time delay relay. Turn it on, and if it isn't smoking after 45 seconds, the relay clicks in, and everything gets hit with volts from some very large (amps continuous) power supplies. Yet they always come back to life. I swapped notes with Stan Griffiths on this a while back, and both of us have only had to replace a very few that had lost their capacitance.

(Note: the MIL SPEC on capacitor testing advises to use a reforming current of about 5 ma. Bill Carns of the Collins community tells of carefully reforming many many electrolytic caps with a max of 5 MA reforming current and very high success rate. Further note, that MIL SPEC has some seriously dangerous assumptions - to not do what it says with paralleled capacitors.)

Generally, when I light up an unknown scope for the first time, I have VTVM's on all of the power supply voltages (-150, 100, 225, 350, 500) and watch them as the relay clicks in. Generally the meters jump to life right where I would expect them, and most of the time, if they don't, it's poor contact with one of the regulator control tubes. I do limit the first run to a couple of minutes after the relay kicks in, and do a couple of more short (5-10 minute) runs while checking to see if the CRT lights up and if the horizontal stuff is working. That's forming with a vengeance.

I'd hang some voltmeters on those Aerovoxes and hit them with working voltage applied to the other end of some 100 ma. current limiting resistors, and watch them come up. Turn them on and off a few times and let them cool if they are slow to come up. After toasting with low leakage for half an hour, check them for capacitance and low series resistance. Generally, when a cap of this type is tired, it will discharge to ground

through 1K, then the voltage (measured on a typical 11 megohm VTVM) will come back up to 10% or more of the charging voltage. That's the sign of a sick puppy. I've got a 1944 box with a bunch of 3-section Aerovoxes (20-20/450, 40/50, I think) that are all bad (series resistance). FP's generally come right up, even the 1941 jobs, unless they're leaking "coolant" (obvious) or have dried out.

The ones that would short were the wets from the 1930's. My theory on this is that the electrolyte attacked the plates and the metal ions in solution made them conduct, with no film interface. The drys are not "dry," but the electrolyte is held in a blotting paper. All of the electrolytes I know of are boric acid based, but I think the manufacturers got smart about putting corrosion inhibitors in these (always proprietary) solutions by 1940.

The little caps that get hot and go bang, like firecrackers, are tantalums, and I think their electrolyte is a nitric acid based solution. Very nasty. I recall having lots of trouble with popping tantalums in the '60's, but most of this was traced to installation with reversed polarity. Hank

John Poulton measured a number of new old stock silver mica caps and reports his results at: http://jptronics.org/Collins/silvered_micas/ ?My conclusions. NOS silver micas retain their leakage resistance performance exceptionally well over time. NOS silver micas also are very stable over time for their rated capacitance values. I would not hesitate to replace a silver mica cap with a vintage silver mica cap, but I would not do so without confirming leakage resistance and capacitance values first. ?

Roy Morgan
K1LKY since 1958
k1lky68@gmail.com Western Mass

Date: Sat, 2 Apr 2022 16:47:05 +0000 (UTC)
From: Jim Whartenby <old_radio@aol.com>
Subject: Re: [R-390] Carrier Level Meter Issues

Henry, yes, your method of leakage testing may work but the time constant formed from such a large series resistance and a typical value of electrolytic filter capacitor eats up a decent slug of time. 10 megs of resistance used to charge a 40uF capacitor results in one TC of 400 seconds.? It takes at least 5 TC's to fully charge a capacitor or 2000 seconds or better then half a hour.?

To keep the VTVM meter pointer from being pegged, the voltage range has to be at a setting higher then the supply voltage, as you said, The meter reading will then slowly decrease as the capacitor slowly charges but

should not result in a usable reading for perhaps 20 minutes. Once charged for two or three TC's, the voltage across the filter capacitor could be quite high but there is no method mentioned to safely discharge the capacitor when the testing is finished. Is this a fair assessment?

I don't typically bother to test small capacitor values for leakage, I just replace them outright. That said, I don't normally replace high quality filter caps without first doing a leakage test. My setup just limits the short circuit current to around 25 mA or so. This way I can disconnect the filter cap from the rest of the circuit and then connect it to the capacitor leakage tester. While the cap is under test, I do something else like cleaning the chassis or testing resistors for wildly out of tolerance values. It doesn't hurt to do a critical assessment of the chassis and look for things that are out of sorts or troubling.

I should also mention that the leakage tester also has a resistor from the bridge rectifier to common (ground). This resistor draws about 2 mA at all times so that once the test is over and the tester is turned off, the capacitor under test will discharge automatically,

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Date: Sat, 25 Feb 2023 19:01:07 -0500
From: John Wendler <wendlerjrv@gmail.com>
Subject: [R-390] C553 replacement?

The C553 in one of my IF modules is a Sangamo Vitamin Q capacitor, 0.01 uF, 300 V. It looks good visually and is not a Brown or Black Beauty of Death. What's the group experience with the reliability of the Vitamin Q caps?

Date: Sat, 25 Feb 2023 17:17:55 -0800
From: Renee K6FSB <k6fsb.1@gmail.com>
Subject: Re: [R-390] C553 replacement?

Very seldom have had an issue, in fact never and that is in both 390 and 390A...i still have a few VitQ caps pulls from dis-guarded equipment and they are still good.... they are wonderful!

Date: Sat, 25 Feb 2023 21:52:56 -0500 (EST)
From: Barry <n4buq@knology.net>
Subject: Re: [R-390] C553 replacement?

If I'm not mistaken, Dave Medley (and others) suggest that 180v regulator issues in the R390 might be due to leakage in C606 and/or C608 and I think those are typically Vitamin Q capacitors.

Date: Sat, 25 Feb 2023 19:11:07 -0800

From: Larry H <larry41gm@gmail.com>
Subject: Re: [R-390] C553 replacement?

Hi John, Although I've not done a study on Vitamin Qs, I've heard that they are very reliable. But, I believe they still do fail and the risk is unnecessary. Replace it with the recommended cap (SBE series 225P, 418P or 715P Orange Drop 'film and foil', NOT 'metalized film' rated at least 500V).

Date: Sun, 26 Feb 2023 04:03:27 +0000 (UTC)
From: Jim Whartenby <old_radio@aol.com>
Subject: Re: [R-390] C553 replacement?

A quick look at the R-390 Collins preliminary manual indicates that C-606 and C-608 are both rated at 100 vdcw.? Curious that C-608 has 174 volts across it according to the voltage table for V-607. I did not find C553, which tube is associated with it?

Date: Sat, 25 Feb 2023 23:08:21 -0500 (EST)
From: Barry <n4buq@knology.net>
Subject: Re: [R-390] C553 replacement?

I think C553 is only in the R390A.

Date: Sun, 26 Feb 2023 10:34:22 -0500
From: David Olean <k1whs@metrocast.net>
Subject: Re: [R-390] C553 replacement?

They seem to last forever. I have run into a few that have started to leak and have replaced them for that reason. I never found a bad Vit Q. that caused an electrical problem.

Date: Sun, 26 Feb 2023 11:03:43 -0600
From: Cecil acuff <chacuff@gmail.com>
Subject: Re: [R-390] C553 replacement?

My standard for repair of the 390 series is to replace paper caps on the R-390 “as needed?” based on symptoms and leakage testing, (Which is rarely) and “replace all” in the R-390A as a rule. You can replace as needed in the R-390A but you will be replacing caps on a routine basis until all are eventually replaced. I too have seen next to no Vitamin Q cap failures.

Date: Sun, 26 Feb 2023 20:15:43 +0000
From: David Wise <d44617665@hotmail.com>
Subject: Re: [R-390] C553 replacement?

That's correct, C553 is a coupling cap into the R-390A mechanical filter. It's a catastrophe if it shorts. Many people replace it even though it's a Vitamin Q which should still be good. I kept the old cap and inserted a current limiter, using a Supertex (now Microchip) LND-150 depletion-mode MOSFET. Just connect drain upstream, and source & gate downstream, and voila, 1mA limit.

In the R-390, C606 sees 1/19th of 180V so it will last forever. C608 sees about 180-10+5 or 175V. If it leaks, the regulator will throttle down. If you suspect this, measure voltage across 6BH6 grid resistor R624; it should be zero. Slight leakage is worse than severe leakage, because the 6080?s will overheat.

On pdf page 10 of 34 of TM 11-5820-357-35P, C608 is listed as type CP10A1EE224M. CP is hermetically-sealed paper. In specification MIL-C-25D, the second E indicates 400 volts.

Date: Sun, 26 Feb 2023 21:32:20 +0000 (UTC)
From: Jim Whartenby <old_radio@aol.com>
Subject: Re: [R-390] C553 replacement?

I can verify that C606 in TM 11-5820-357-35P is listed as type CP10A1EE224M as stated?but the Collins Preliminary R-390 Manual on page 186 does list C608 as 0.22uF, +/- 20% at 100vdcw and gives a Sprague P/N, 96P22403S13.? Perhaps a misprint by Collins that was caught when the official military manuals were issued?

Date: Sun, 26 Feb 2023 23:04:18 +0000
From: David Wise <d44617665@hotmail.com>
Subject: Re: [R-390] C553 replacement?

Sprague type 96P is a Vitamin Q impregnated hermetic paper cap rated for 125C operation. In the 1972 United Technical Publications ?Master? 37th edition, Section 1500, source page 212, Sprague advertises that they exceed MIL-C-25A, the military specification for style CPxx.

Date: Sun, 26 Feb 2023 21:32:48 -0500
From: Dan Martin <pitfit@comcast.net>
Subject: Re: [R-390] C553 replacement?

10-20 years ago there were stories alleged of hundreds of destroyed mechanical filters due to stock C553 failures. Puzzled operators, concerned about the mysterious loss of a filter, would quickly switch to each of the alternate filters to confirm their function and would thereby sequentially destroy the entire filter bank. Who hasn't heard those stories

around a campfire?

Replacing C553 with a Sprague (now CDE) Orange Drop used to be the unquestioned first thing in any refurbishment. Chuck Rippel wouldn't let a 390A leave his shop without an Orange Drop in place for C553. Now it seems Vitamin Q's, like Golden Retrievers, are our best friends and never turn on us and go bad. Really, not picking a fight, my friends. Just appreciating the comments re: what had been unquestioned convention "back in the day." And yes, my '67 EAC has a 20 year old by-gawd Sprague Orange Drop in place for C553, not some upstart CDE branded version.

Date: Sun, 26 Feb 2023 20:44:15 -0600
From: Cecil acuff <chacuff@gmail.com>
Subject: Re: [R-390] C553 replacement?

It's certainly one of the first that should be tested for leakage if not just replaced because!

Date: Sun, 26 Feb 2023 22:50:31 -0500
From: John Wendler <wendlerjrv@gmail.com>
Subject: Re: [R-390] R-390 Digest, Vol 224, Issue 4

Thank you! Nice trick with the current limiter!

Date: Sun, 26 Feb 2023 22:53:04 -0500
From: John Wendler <wendlerjrv@gmail.com>
Subject: Re: [R-390] R-390 Digest, Vol 224, Issue 3

Thanks!

Date: Mon, 27 Feb 2023 06:38:07 +0000 (UTC)
From: Jim Whartenby <old_radio@aol.com>
Subject: Re: [R-390] C553 replacement?

Well, nothing is forever so I guess there have been some C553 failures but I suspect that chances are much better then even that an R-390A mechanical filter will fail by itself either with the internal isolator turning into a sticky, gummy mess or one of the coil wires will break from fatigue at the feedthrough.? I have seen both over the years but have not experienced a single C553 failure.

If filter failure due to current leakage of C553 is a real concern, why not series connect two 0.02 uF caps of your favorite construction?? The chances of two capacitors that are operating well below their rated voltage failing for leakage at the same time should be minuscule.

As an aside, my experience with Collins equipment is that the mechanical filter most likely to fail will have a narrow passband so in the R-390A, the 2 kc filter has a better chance of failure then the 16 kc filter.? Case in point is the ARR-42 that I am currently working on has a bad 1.4 kc CW mechanical filter but the 6 kc AM filter is just fine.

Date: Mon, 27 Feb 2023 02:00:28 -0500
From: mvjohn <mvjohn@sympatico.ca>
Subject: [R-390] R390a Mechanical Filters

Has anyone found a suitable replacement for failing mechanical filters? My 4khz filter is shot - deaf - and repairing it does not look likely.

Date: Mon, 27 Feb 2023 12:32:32 -0500
From: John Vendely <jvendely@cfl.rr.com>
Subject: Re: [R-390] C553 replacement?

It is with great trepidation that I venture to comment on this perennial subject. But the fact is that the Vitamin Q and other related capacitor designs were the result of a very large, intensive DOD/industry effort to research the unacceptably high failure rate of paper dielectric capacitors and drastically reduce them. They succeeded. These capacitors have excellent reliability, and in 50+ years of working on large quantities of this old gear, I've seen few failures.

That said, there's certainly no harm in replacing C553 prophylactically, but the fact is we probably do get a bit obsessive about it. Based on experience, I agree that the failure rate of these old filters themselves is far higher than the failure rate of a Vitamin Q capacitor at C553...

Date: Mon, 27 Feb 2023 11:59:58 -0600
From: "Joseph Koester" <jwkoest@charter.net>
Subject: Re: [R-390] C553 replacement?

I see the Vitamin Q caps that were put into old radios as replacements and in most cases that have also failed over time. My favorite for restoring old Zeniths and such have been the Sprague Orange Drops, although the proliferation of the small yellow, mylar I believe, caps have become quite popular in the old radio scene.

Date: Sat, 4 May 2024 04:57:23 -0700
From: Larry H <larry41gm@gmail.com>
Subject: Re: [R-390] R-390 Q of Caps and tuned circuits

Wow, this is a lot of great posts about the Q of caps. And it is all very

good to know. But, my original hope in posting on this subject was to try to find a simple answer that would work all of the time to prevent using the wrong cap in critical circuits. It looks like it isn't going to be easy. Perhaps a list of caps that have a high enough Q is necessary as a guideline. As I noted previously, the MIL-C-5 spec requires the Q to be above 1,333. Is this a good starting point? I have seen a lot of new ceramic caps mentioned that have a high Q, but some of them are surface mount only, no wires attached.

Dave, The Q info I referred to came off of the manufactures spec datasheets, I didn't do any measurements. Your post from Apr 30, 2024, 5:30?PM has a lot of great info in it.

There are a lot of 390 users/owners worldwide, about 700 unique users per month on our website last year (with June having 897). I suspect that most of them have faced or will face a bad SM cap in a high Q circuit, as SM caps will continually go bad. It would be nice to come up with an easy way to determine if a cap is an acceptable substitution or not. I hope something easy is possible. Any suggestions?

Date: Sat, 4 May 2024 15:56:35 +0000
From: David Wise <d44617665@hotmail.com>
Subject: Re: [R-390] R-390 Q of Caps and tuned circuits

Nothing revolutionary, just replace paper with plastic, ceramic with ceramic, mica with mica. Especially in the latter case use brand-new, not old or even NOS unless tested good in every possible way.

Date: Sat, 4 May 2024 16:33:09 +0000 (UTC)
From: Jim Whartenby <old_radio@aol.com>
Subject: Re: [R-390] R-390 Q of Caps and tuned circuits

I would add that one should pay attention to the ceramic capacitor dielectric used in the circuit.? Some are very temperature sensitive and are a source of noise and microphonics.? See:https://www.electronics-notes.com/articles/electronic_components/capacitors/ceramic-dielectric-types-c0g-x7r-z5u-y5v.php

Also some tuned circuits use negative temperature coefficient capacitors to compensate for changes that occur over the operational temperature range.

Date: Sun, 5 May 2024 04:40:49 -0700
From: Larry H <larry41gm@gmail.com>
Subject: [R-390] The R-390A Mechanical Fillter ?killer? cap C553

Hi all, I just updated my document (R-390 Newbie Support Info) on our website with a new paragraph at the end called: Replace the R-390A Mechanical Filter ?killer? cap C553. This is something that all folks new to the R-390A should know. Here's a link to the document: R390 Newbie Support Info
<https://www.r-390a.net/R390%20Newbie%20Support%20Info.pdf>

Date: Sun, 5 May 2024 17:17:19 +0000
From: David Wise <d44617665@hotmail.com>
Subject: Re: [R-390] The R-390A Mechanical Fillter ?killer? cap C553

Since my C553 is hermetically sealed, rather than remove it, I inserted a current limiter. It's extremely simple, just a high-voltage depletion-mode MOSFET: the Microchip (nee Supertex) LND150. Drain towards positive, source+gate towards negative. If the cap ever lets go, the FET limits the current to Idss, i.e. 1 to 2 mA.

Date: Sun, 5 May 2024 18:59:58 +0000
From: David Wise <d44617665@hotmail.com>
Subject: Re: [R-390] The R-390A Mechanical Fillter ?killer? cap C553

My email program glitched and made your post vanish, I'm answering from memory. The LND150 drain-source breakdown rating is 500V. They're in stock at at least two major distributors (Mouser and DigiKey) for less than a buck. I've never seen a glass-metal hermetic cap leak.

Date: Thu, 4 Jul 2024 21:06:10 +0000 (UTC)
From: jkharvie <jkharvie@verizon.net>
Subject: [R-390] Paper on failure modes of mica capacitors (historical)

As attached, cheers John N3JKE
---------- next part ----------
A non-text attachment was scrubbed...
Name: 1959 article on failure mechanisms of mica dielectric capacitors.pdf
Type: application/pdf
Size: 1454812 bytes
Desc: not available
URL: <http://mailman.qth.net/pipermail/r-390/attachments/20240704/bca45b82/attachment-0001.pdf>

Date: Fri, 5 Jul 2024 06:40:15 +0000 (UTC)
From: Jim Whartenby <old_radio@aol.com>
Subject: Re: [R-390] Paper on failure modes of mica capacitors (historical)

This paper is from Great Britain. I am not sure that they manufactured

capacitors with the same materials and technique that the U.S. manufacturers used. When the Cold War was heating up in the early 1950's all of the U.S. component specs were rewritten to insure the best manufacturing practice for increased reliability. I am not sure what happened on the other side of the "pond" in this respect. It seems to me that the vast majority of the component issues were solved in the U.S. by the mid to late 1950s which was when this paper was published. Perhaps some of our fellow R-390 owners in Great Britain can comment

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Date: Fri, 5 Jul 2024 07:06:49 -0500
From: "Les Locklear" <leslocklear@hotmail.com>
Subject: Re: [R-390] Paper on failure modes of mica capacitors (historical)

Virtually all the "Hunt" branded capacitors in the Racal RA-17 series failed. I guess you call if the British version of the Black/Grey ladies of death that were in lots of different receivers, but mainly Hammarlund SP-600's.

Date: Fri, 5 Jul 2024 06:23:14 -0600
From: "Jordan Arndt" <Outposter30@shaw.ca>
Subject: Re: [R-390] Paper on failure modes of mica capacitors (historical)

Yes, Hunt's were/are notorious for failing and splitting along the seams of the molded covering.... They were used in North American equipment as well, such as Stromberg Carlson P.A. amplifiers...

Date: Tue, 9 Jul 2024 01:00:04 +0000 (UTC)
From: jkharvie <jkharvie@verizon.net>
Subject: Re: [R-390] Paper on failure modes of mica capacitors (historical)

Jim,A great topic to consider. I am sure some history books have a umber of excellent resources on this topic.? Very early days of understanding what was needed for long term reliability. Points of divergence and convergence in adopting standards, including those for interoperability, material qualifications, MTBF etc.I am reminded that a number of Apollo missions had a number of "events" identified as being associated with loose material within panel switches that required work-arounds. In reviewing photographs of early manufacturing it is clear that contamination control and the concepts in improving infrastructure design for contamination control started in early 1960's. ?A brief Google search indicates that Willis Whitfield, received a patent for his concept of a "Cleanroom" in U.S. Patent No. 3,158,457 His design standardized cleanrooms across the globe, enabling better research and development of technology that surrounds us.
