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Subject: Air Dielectric caps

Posted by [Manualblock](#) on Sun, 08 May 2005 14:04:09 GMT

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So whats the scoop with these things. Are they good for RIAA circuits since they can be fine-tuned?

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Subject: Re: Air Dielectric caps

Posted by [Wayne Parham](#) on Sun, 08 May 2005 19:48:17 GMT

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Variable capacitors are used in the tuners of radios. They have small capacitance values, in the picofarad range, because they are physically small. Capacitors are simple devices, and using a moving mesh of plates to provide adjustable capacitance is perfect for for a tuner.

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Subject: Dielectric Constant

Posted by [muman](#) on Mon, 09 May 2005 01:07:04 GMT

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That has been universally dissed. Dielectric properties are poor and they shift which is why old radios lose their station. Crystals were used for accurate tuning because of that. Imagine how changes in humidity and particulates change the dielectric of that kind of capacitor. The dielectric constant of a vacuum is 1.0, air is ~1.0001 and plastics are 2-3 (depending on which one). Paper is 2-6 (depending on what it is impregnated with) and mica is 6.8. All of these are better and more consistent dielectrics than air.

Capacitors and Dielectrics

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Subject: Re: Dielectric Constant

Posted by [Manualblock](#) on Wed, 11 May 2005 17:58:39 GMT

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I know but they set the value then cement the vanes in place. Someone did a study and found that a 30% change in humidity translates to a less than 1% change in regulation. So if that is correct it would make them attractive for use as adjustable RIAA caps.

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Subject: Universally dissed?

Posted by [Triode\\_Kingdom](#) on Thu, 12 May 2005 19:29:36 GMT

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I don't think so. Just try to find a forty-year-old air cap that leaks like paper. Air and vacuum exhibit less loss, no hysteresis, no aging, a neutral sonic signature, and best of all, they are adjustable. If you can find suitable values in a reasonable size, go for it!

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Subject: Re: Universally dissed

Posted by [muman](#) on Thu, 12 May 2005 21:49:54 GMT

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That's right --- universally dissed. No one but crackpots use capacitors like those for audio. Even radio receivers have abandoned them, except the cheap ones, of course. Air is one of the lowest dielectrics there is. It isn't uniform either and the plates are free to vibrate too. Neutral sonic signature my arse.

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Subject: Here's a thought

Posted by [Wayne Parham](#) on Fri, 13 May 2005 05:06:46 GMT

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Some of the better grade capacitors use pure copper and even silver film plates. Caps the size we're talking about here are generally less than 400pF and are no larger than about 102 inches total plate area, with ~1/32nd inch air gaps between plates. For low voltage circuits, the gap can be smaller, making higher capacitance or smaller plate areas possible. Capacitors like these could easily be made with aluminum, copper or silver film sheets, trimmed to size. One way to do it is to make several 1" square layers separated with wax paper or whatever other insulator is desired. If you want air as the dielectric, just use thicker plates so they don't flex and touch. Separate them with thin nylon washer spacers and hold them together with nylon screws. That way you'd get the flexibility of tuner caps while using better quality materials. Just a thought.

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Subject: Re: Here's a thought

Posted by [Manualblock](#) on Fri, 13 May 2005 13:21:28 GMT

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What would you do then; dip them in something like orange drops?

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Subject: Sorry, you're wrong

Posted by [Triode\\_Kingdom](#) on Fri, 13 May 2005 17:50:14 GMT

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>Dielectric properties are poor and they shift which is why old radios lose their station. Not true. Old radios drift primarily due to the inductors and positive coefficient ceramic capacitors. That's why NPO capacitors were developed. >All of these are better and more consistent dielectrics than air. You obviously don't know much about the electrical properties of these materials. Paper is used only where the advantage of its higher dielectric constant outweighs its otherwise poor qualities. It cannot be used in frequency-sensitive circuitry. Its dielectric constant changes over time, as does its leakage and loss, and it is extremely sensitive to changes in temperature. Please stand in the corner until you get this right.

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Subject: Re: Here's a thought

Posted by [Wayne Parham](#) on Fri, 13 May 2005 22:10:36 GMT

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Sure, you could pot the capacitor if you wanted.

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Subject: Re: Sorry, you're wrong

Posted by [muman](#) on Fri, 13 May 2005 22:50:51 GMT

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Let me guess --- this RIAA circuit is something you do. The best tuner capacitors are sealed and use a real vacuum. Those tuner caps in old radios \*are\* the cause for drifting. Ceramic capacitors weren't usually in them, mica was. Some old tubular ceramic capacitors were used, but they didn't drift like disc ceramics. Better tuner caps use mica or poly film between plates. Better still to tune with a crystal or a digital synthesizer. Leave the tuner caps for use as long wire resonators aka antenna tuners.

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Subject: Re: Sorry, you're wrong, with references

Posted by [muman](#) on Sat, 14 May 2005 04:31:58 GMT

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Do a search on the internet for "paper oil capacitors". Not talking about oil filled capacitors. That's industrial, an audio fad. Look for paper in oil. It shows a veritable top dawg list of biggest players in high end hifi. To name a few, try Jupiter Beeswax, Angela, Audio Note, Sprague, Jensen,

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Goodall, Gudeman, Astron, West, Dearborn and so on. Steve Bench says "paper in oil is extremely clean, best of the group. That may be one reason why some people prefer the sound of the paper capacitors. Although not recorded, oil capacitors in general appear to be very linear. These caps also appear to have relatively stable characteristics with change in frequency." <http://members.aol.com/sbench102/caps.html> <http://www.jupitercondenser.com/jupitercapacitors.htm> [http://www.angela.com/catalog/capacitors/Angela\\_PIO.html](http://www.angela.com/catalog/capacitors/Angela_PIO.html) [http://www.audionote.co.uk/kits/an\\_capacitors\\_paper\\_in\\_oil.htm](http://www.audionote.co.uk/kits/an_capacitors_paper_in_oil.htm) <http://www.referenceaudiomods.com/htmldocs/JAFPIO.html> <http://www.referenceaudiomods.com/htmldocs/JCFPIO.html> <http://store.tubedepot.com/vinoip.html> I'm not going to discuss this with you anymore. If you like using old tuner caps that's just peachy with me. I just think it's a weird fad and you could do better, that's all.

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Subject: Re: Dielectric Constant  
Posted by [metasonix](#) on Sat, 14 May 2005 19:52:00 GMT  
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>Imagine how changes in humidityHumidity?

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Subject: Your references say nothing about air because ...  
Posted by [Triode\\_Kingdom](#) on Sun, 15 May 2005 04:11:08 GMT  
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they're referring to values larger than are practical with air caps. That doesn't contradict decades of engineers who know air and vacuum caps are much more stable than those other dielectrics. Like you, I don't care what components you use, but your limited knowledge in this area is likely to mislead other readers. Ask Steve Bench if he would use a paper/oil cap to trim the oscillator in an FM receiver. You just don't know this topic.

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Subject: Do whatever you want.  
Posted by [muman](#) on Sun, 15 May 2005 05:17:37 GMT  
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Use rusty nails for all I care.

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Subject: Re: Do whatever you want.  
Posted by [Manualblock](#) on Sun, 15 May 2005 11:06:32 GMT

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So now you pick up your toys and leave? Address the issue. Steve Bench has a reputation for knowing his stuff. Some of us would like to understand this thread.

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**Subject:** Re: Do whatever you want.  
**Posted by** [muman](#) on Sun, 15 May 2005 23:46:52 GMT  
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Not much more to say, IMO. Variable caps were made for radio tuners, and worked with relatively low voltage, high frequency signals. They are not used anymore --- good radios use digital tuners instead. They do have all the other capacitor types though, and they don't drift. The air between plates of tuner capacitors will become ozone and arcing may occur unless voltage remains low. Dust and other particulates can (will) get in between the plates and collect on them. These caps were never meant for audio. It takes a leap of faith to say they will do anything good for audio, and a lot of gumption to say they have a neutral sonic signature. I guess that is one man's opinion, but I don't see any references to support it. No legititmate studies have been done, no manufacturers have come forth with a premium audio capacitor using air as a dielectric. I could see a premium cap made with a vacuum dielectric. That might be good. I'm skeptical that scavenging old radio tuners is good for audio circuits though. On the other hand, there has been universal acceptance of other types of caps for audio such as polys, papers, etc.

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**Subject:** Re: Dielectric Constant (of water?)  
**Posted by** [muman](#) on Mon, 16 May 2005 00:55:52 GMT  
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Was that change 0-30% humidity or 70-100%? I would like to see the study someone did. Where did you hear about it? Do you know where I can find it?

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**Subject:** Macanudo  
**Posted by** [muman](#) on Mon, 16 May 2005 01:06:22 GMT  
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My screen is so brown from cigar smoke I couldn't see it sorry. Wait, I'll clean it off and while I'm doing it, I'll clean my capacitors too.

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Subject: I always do

Posted by [Triode\\_Kingdom](#) on Mon, 16 May 2005 05:20:32 GMT

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>Variable caps were made for radio tuners, and worked with relatively low voltage, high frequency signals. You don't know what you're talking about. Air variables were once the mainstay of high voltage circuitry in both receivers and tube-type transmitters. Many are rated at well over a kilovolt.>They are not used anymore --- good radios use digital tuners instead. Depends on your definition of "good." The lowest possible noise floor is achieved with free-running oscillators (caps/coils or crystals), not with digital synthesizers. Digital tuners are stable because they're locked to a crystal, but other aspects of performance suffer due to the synthesis loop.>The air between plates of tuner capacitors will become ozone and arcing may occur unless voltage remains low. Dust and other particulates can (will) get in between the plates and collect on them. You're just guessing. You think that will happen, but in fact, it's not an issue. I have a variable matching network over 50 years old with air caps that I frequently subject to RF voltages in excess of 3 kV. The caps have never been cleaned or serviced, and they work as well as the day they were made.>These caps were never meant for audio. The market for most air variable caps is high voltage, high frequency. Most audio circuits typically need higher values of capacitance than are practical with an air dielectric. I assure you, no one would use chemical electrolytes or oil if they could achieve the same capacitance in a reasonably-sized air capacitor.>It takes a leap of faith to say they will do anything good for audio, and a lot of gumption to say they have a neutral sonic signature. How much do you actually know about dielectric properties? Do you know that all common dielectrics produce audio frequency distortion and hysteresis except air and vacuum?>No legitimate studies have been done. Dielectric properties of insulators such as air, glass, oil, vacuum, and the like have been well defined for decades.>no manufacturers have come forth with a premium audio capacitor using air as a dielectric. For the same reasons no one markets a 100,000 horsepower car - you can't afford it, and it won't fit in your driveway. That doesn't mean it wouldn't be fast. Air capacitors in the values needed for most audio circuitry would be very large and expensive.>I'm skeptical that scavenging old radio tuners is good for audio circuits though. No one has suggested doing that.>universal acceptance of other types of caps for audio such as polys, papers, etc. Of course they're accepted - those dielectrics produce small, affordable components; a convenient, if less than perfect, solution. They're certainly not the equal of air (or direct coupling) though in any fundamental electrical respect.

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Subject: References

Posted by [muman](#) on Mon, 16 May 2005 06:19:44 GMT

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or rubbish

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Subject: Re: References

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Posted by [Manualblock](#) on Mon, 16 May 2005 10:48:17 GMT

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Well; I guess the only way to find out is build it.

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Subject: Re: Dielectric Constant (of water?)

Posted by [Manualblock](#) on Mon, 16 May 2005 10:51:03 GMT

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I'm sorry; I am quoting another source who apparently uses these to do low level circuits. I would ordinarily not offer a fact that I did not check but this seemed harmless. Should the study not appear you have my apology.

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Subject: Re: Reference - "Valve Amplifiers 3"

Posted by [Damir](#) on Mon, 16 May 2005 10:54:27 GMT

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See "Valve amplifiers 3" by M. Jones, pages 211-229, especially Fig. 4.4 - various capacitors types, and the quality of them. The air plate caps are the more nearly perfect, with electrolytic Al-foil/bipolar at the "other side". Then citation: "Possible audio uses (of air dielectric, metal plate) include:- ~300pF variable capacitor across the input of a MM RIAA stage to allow cartridges to be optimally loaded by the pre-amplifier- ~50 pF for trimming equalization capacitors to their exact value" And later, author uses just that - 40 pF variable cap for "trimming" the exact value of RIAA EQ cap in his EC8010 RIAA preamp, Fig. 7.37, page 568. And please, calm down your aggressive tone, one of the reasons why are all here is to avoid "rubbish" from some other forums...

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Subject: "Electrical breakdown is not always associated with high voltage"

Posted by [muman](#) on Tue, 17 May 2005 02:12:20 GMT

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Thank you for the reference. I looked and found Morgan Jones book. I don't agree that air is a better dielectric or that it sounds better, but at least this reference is something. At the microvolt level of a moving magnet cartridge, if the air is clean and humidity controlled, it would work. I work in power systems, and we always consider air to be a problem. The dielectric properties of other insulators are much better. Even an air bubble in an insulator can be catastrophic. Advances in materials have made air gap insulators obsolete, IMO. The fact they aren't used in most good radios anymore says something too. Quoting John J. O'Dwyer, "Breakdown voltage is directly

related to the dielectric thickness. Its counterpart, dielectric strength, indicates the relationship between thickness and breakdown voltage, and is expressed as a ratio of voltage to thickness. Thermal effects due to local Joule heating can cause thermal breakdown at sufficiently high temperatures. This correlates to electrical conductivity through an exponentially increasing function of the temperature. Other factors that contribute to breakdown include particulates, material contamination and water vapor. Each can influence breakdown; actions must be taken to eliminate their contribution to breakdown voltage measurements. Humidity, for example, reduces the resistance of most dielectrics, thus increasing the return current (the current that opposes a charge build-up). Contamination can contribute to leakage currents and charge mobility across isolation areas."Two plates separated by a 1mm air gap will arc with 3000 volts, and can as low as 300 volts. Air is a fluid mixture and unless controlled, it is a nonspecific gas. Water vapor is a big factor in reducing the dielectric strength of air (or any other dielectric, for that matter) and other contaminations also contribute to modify dielectric properties. It's a crap shoot with air so I don't think an open capacitor is the best way to go.

Electrical breakdown is not always associated with high voltage

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Subject: Air Caps, Right Here, Get 'em While they're Hot!!!  
Posted by [Triode\\_Kingdom](#) on Tue, 17 May 2005 05:39:44 GMT  
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Note that I have no personal or professional relationship with any person at this company.  
Air Dielectric Trimmers

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Subject: MODERATOR  
Posted by [akhilesh](#) on Tue, 17 May 2005 21:13:00 GMT  
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PLease check some posts below in this thread. I believe they go against the spirit of ART. Just FYI: a heads up. -akhilesh

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Subject: Re: MODERATOR  
Posted by [Manualblock](#) on Tue, 17 May 2005 23:30:41 GMT  
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AK; Hey, E-mail me off line.

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Subject: Re: Get 'em While they're Hot!!!  
Posted by [muman](#) on Wed, 18 May 2005 03:25:08 GMT  
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I would not use those past 10% voltage listed, if even that. You don't have to melt the plates for corona discharge to adversely affect quality.

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Subject: Bolivars  
Posted by [PakProtector](#) on Fri, 20 May 2005 23:05:36 GMT  
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from the Island...if your screen is brown, imagine what your lungs must look like, or for that matter how they function. A good friend of mine just got a 4x bypass from a few decades of smoking. 9 hrs with his chest split open...no thanks.regards,Douglas

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