

|              |  |   |
|--------------|--|---|
| Part #:      | <b>Grounding device tester</b>                                       |    |
| Description: | See a green light if passing and red/yellow with an alarm if failing |  <a href="#">Download Datasheet</a>  |

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**Hello volvo\_nut\_v70**

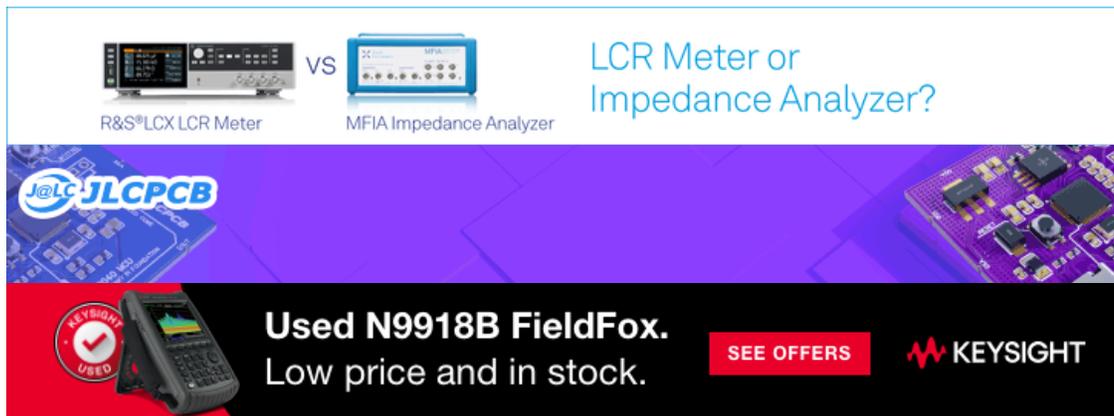
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May 26, 2022, 06:19:14 pm

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EEVblog Electronics Community Forum » Products » Other Equipment & Products » relay contacts and fouling?



Advertisement for LCR Meter or Impedance Analyzer. It features images of an R&S LCX LCR Meter and an MFIA Impedance Analyzer. The text asks "LCR Meter or Impedance Analyzer?". Below this is a banner for JLCPCB. At the bottom, there is a KeySight advertisement for the N9918B FieldFox, stating "Used N9918B FieldFox. Low price and in stock." with a "SEE OFFERS" button.

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Author

Topic: relay contacts and fouling? (Read 928 times)

volvo\_nut\_v70 and 0 Guests are viewing this topic.

**coppercone2**

Super Contributor



Posts: 6189

Country:

\$



**relay contacts and fouling?**

« on: July 27, 2020, 12:17:39 am »

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SO I took apart a variac I built a long time ago on a 'used shoe string i found on the street' budget in order to refurbish it with real wire, and I noticed the brass bit that makes contact with the copper bit that contacts the carbon wiper is completely and utterly fouled, but the unit was still working (no doubt it got hot here, but it never smelled or did anything weird, thought its only a 3A unit).

However, I have taken apart totally non functional AC relays, and found so little fouling (I mean you had to look at it with bright light to see a bit of discoloration). These things read like 1 meg. I almost got pissed and thought my meter broke it looked so good.

Do certain platings on modern components cause them to be non robust? Does brass just not fail in the open circuit way ?

This contact.. I was not even sure if it was brass until I scratched it. I thought it might be a lump of carbon. Its tensioned against a little copper pin that contacts the wiper.

« Last Edit: July 27, 2020, 12:21:46 am by coppercone2 »

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**duak**

Super Contributor



Posts: 1013

**Re: relay contacts and fouling?**

« Reply #1 on: July 28, 2020, 03:00:45 am »

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Country: **coppercone2**

Super Contributor



Posts: 6189

Country: 

\$

**floobydust**

Super Contributor



Posts: 5248

Country: **coppercone2**

Super Contributor



Posts: 6189

Country: 

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**floobydust**

Super Contributor



Posts: 5248

Country: 

Phosphor bronze is often used for springs and it's much more corrosion resistant. I don't know how to describe the color but like most copper alloys it's yellow with a tint that makes it distinct from brass.

Report to moderator  Logged**Re: relay contacts and fouling?**

« Reply #2 on: July 28, 2020, 03:54:00 am »

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well i mean, how come this exposed variac works fine when its corroded/smatted to crap but a hardly noticeable spot of corrosion on a sealed relay connected to a simple heater reads 1 meg with almost invisible tarnish/ware making a circuit useless? Also, the relay is circa 2010? whereas the variac is 1950-60? The corrosion on the relay did not even look like.. dark/weird, just discoloration of the metal. but its enough not to contact at all.

rubbing vs slapping?

« Last Edit: July 28, 2020, 04:03:28 am by coppercone2 »

Report to moderator  Logged**Re: relay contacts and fouling?**

« Reply #3 on: July 28, 2020, 04:34:14 am »

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I think you are asking about "[wetting current](#)"? A multimeter on ohms with say 0.5mA test current is not going to do it, cut through the oxidization film. Many platings, the passivation layer creates a weak diode junction, this is why you get distorted audio or zany connections with (dissimilar) metal objects.

But a variac has higher currents and friction/vibration, like a relay that gets operated the contacts rub and chafe - so it cuts through after a few cycles.

There is also compatibility between two dissimilar metals, so brass on copper, carbon on copper or brass - you can get corrosion (ion migration) due to a (shorted) half-cell potential that occurs. Like a steel bolt through aluminium, it corrodes and makes a bad connection.

Oxidation depends on the environment- sulfur, humidity and then there is 'chinese drywall' off-gassing that is terrible for some metals. I don't know why silver is used in electronics anymore, it turns black all my old LED's are like tarnished silverware.

Report to moderator  Logged**Re: relay contacts and fouling?**

« Reply #4 on: July 31, 2020, 03:21:44 am »

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its not wetting current, both devices are 120VAC, the variac is only 3A but the relay was 10A (heater)

so the sealed 10A relay failed from almost invisible fouling whereas the 3A variac was functional with what looked to be a coal lump sliding around

I tested the relay with a DMM, and I found it because it was not functional (turned out the 120VAC heating coil was fine). It read 1 meg. I did not test the variac but instead cleaned it during a different component replacement because it looked bad (I opened it to replace stuff I knew I did not do the best with and it was bothering me). I Had used it right before to test a device.

« Last Edit: July 31, 2020, 03:45:38 am by coppercone2 »

Report to moderator  Logged**Re: relay contacts and fouling?**

« Reply #5 on: July 31, 2020, 04:14:09 am »

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I don't get what problem you are seeing. The sealed high current 10A relays are dead, open contacts? Heaters are an inductive load.

I've only seen failed contacts due to arcing with consequential metal vaporizing, commonplace in appliance relays. You can see the soot where the metal condenses on the inside plastic housing.

Otherwise, there's a passivation layer on the contacts that can be rubbed off by operating the relay many times or passing sufficient wetting current through them, say a few hundred mA. Never seen a relay fail due to slime on the contacts with a decent load unless the coil was under-volting.

I have had problems with brand new sealed "low signal"? relays failing after reflow, [Omron G6K-2F-DC5](#) and apparently it can happen due to off-gassing. The contacts react with the gas evolved from something inside the sealed relay (epoxy?) during reflow.

For the variac, the carbon is under higher force, lower current density, wipes off with every turn, and doesn't form an insulator when it has oxidized.

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### sokoloff

Super Contributor



Posts: 1494

Country: 



### **Re: relay contacts and fouling?**

« Reply #6 on: July 31, 2020, 04:20:11 am »

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Heaters are an inductive load? I'd have thought of them as a resistive load with insignificant inductance.

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### coppercone2

Super Contributor



Posts: 6189

Country: 

\$



### **Re: relay contacts and fouling?**

« Reply #7 on: July 31, 2020, 04:25:38 am »

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there was no soot, it looked very clean, only slightly discolored. I had to hold it at an angle to a bright light to even see the problem. It just strikes me as a very weak design.

I pulled a much more foul relay out of a freaking abandoned industrial water control facility control panel left in the woods, and it was poorly sealed, totally disgusting, but when I scraped the oxide off the plug terminals I recall it actuating and showing continuity on a hand held cheap DMM. But that was 1950's tech. I had to take the cover off to get the mud out of the mechanism (clogged) but still.

It just strikes me as odd as this power relay looked like it broke from basically nothing. It was a OMRON in a industrial controller. I feel let down. I thought they had to be seriously gnarly to fail. I could describe this one as slightly balding on the plating.

« Last Edit: July 31, 2020, 04:31:01 am by coppercone2 »

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### floobydust

Super Contributor



Posts: 5248

Country: 



### **Re: relay contacts and fouling?**

« Reply #8 on: July 31, 2020, 04:43:03 am »

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I would redo the autopsy, it could be a crooked armature or mechanical fault. With relays and other switch contacts, I was taught by a telecom tech to use a piece of clean printer paper as "sandpaper" to pull through the closed contacts, to clean them and also see what comes off. It works great.

Usually it's the opposite problem - the contact resistance reads OK with a DMM but it doesn't work with the real load. Multimeters can suck with their low test current on ohms, one reason the old Simpson 260 is still around. It pushes ~130mA at 1.5V on Rx1 and doesn't get fooled.

**Quote from: sokoloff on July 31, 2020, 04:20:11 am**

Heaters are an inductive load? I'd have thought of them as a resistive load with insignificant inductance.

Mains heating elements the resistance wire is coiled with many uH inductance and notice the arc when the switching happens. Measure L someday on one.

Oven elements the resistance wire is inside MgO powder inside a steel tube. The inductance back-EMF is hard on triacs and relay/switch contacts.

« Last Edit: July 31, 2020, 04:51:54 am by floobydust »

[Report to moderator](#)  Logged

### coppercone2

Super Contributor



Posts: 6189

Country: 

\$



### **Re: relay contacts and fouling?**

« Reply #9 on: July 31, 2020, 04:50:28 am »

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I threw it out a few months ago because I ordered a similar (not identical IIRC) replacement and reassembled the thing. I just remembered it when doing this variac job. I thought it might be a common thing. I don't remember if I tested it open, I want to say probably because I usually enjoy watching the mechanical devices operate open. But I do not recall. I think it was a violent disassembly, because it was not one of those relays you can pop the top off, it was glued, so its entirely possible I messed up the mechanism during opening anyway. I have some relays that rely on clips to keep the cover on, which can be inspected and possibly cleaned, reassembled and maybe even replated, but I do not think this was one of those kinds. Maybe next time I will cut it with a dremel rather than smashing it open with pliers.

Maybe I should consider saving broken components, but usually I am happy and relieved to throw them away. (no space)

It would be nice if there was a relay replating guide, because I hate having to buy fairly expensive relays to fix dubious use equipment that I end up fixing just not to have broken things. Makes the margins not so sweet.

« Last Edit: July 31, 2020, 05:02:00 am by coppercone2 »

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floobydust

Super Contributor



Posts: 5248

Country:



**Re: relay contacts and fouling?**

« Reply #10 on: July 31, 2020, 06:06:45 am »

Say Thanks

Reply

Quote

I forgot to mention - silicone contamination can also be a huge problem.

If you use silicone oil, an entire building/facility can be contaminated forever as it's like a chlorofluorocarbon, it doesn't go away. Nasty stuff.

**Penetration Process of Silicon Gas**

1) The relay is used in an environment in which silicone gas is present.



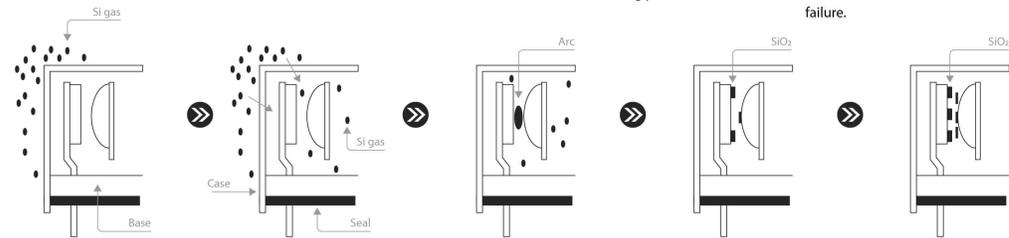
2) The silicone gas penetrates into the relay through its case or through the gaps between the parts that are fit together.



3) The arc energy during contact load switching converts the organic silicon (Si) into silicone oxide (SiO<sub>2</sub>), which adheres to the contacting point.



4) The silicone oxide accumulates as the count of switching operations increases, which increases the contact resistance. This results in the contact failure.



silicone contamination\_relay.jpg (121.28 kB, 2623x1030 - viewed 41 times.)

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coppercone2

Super Contributor



Posts: 6189

Country:

\$



**Re: relay contacts and fouling?**

« Reply #11 on: July 31, 2020, 02:34:56 pm »

Say Thanks

Reply

Quote

does wd40 spray silicone lubricant qualify as a silicone oil?

I assume it has to be some kind of volatile silicone?

I assume the biggest fouler is vacuum pumps? Kind of not separable from a industrial facility.

« Last Edit: July 31, 2020, 02:38:03 pm by coppercone2 »

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floobydust

Super Contributor



Posts: 5248

Country:



**Re: relay contacts and fouling?**

« Reply #12 on: July 31, 2020, 10:40:20 pm »

Say Thanks

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Quote

WD-40 is petroleum-based, **50-70% kerosene (jet fuel) as a solvent** plus ~35% mix of five mineral oils. It evaporates off quickly and the paraffin oil stays around for a bit longer. It's not good for a long-term lube due to the light oil, evaporates in a few days. WD-40 silicone is 60-80% kerosene (jet fuel) as a solvent plus ~1-5% mix dimethylsiloxane. That stuff is everywhere: food, sex toys, deep fryer grease etc.

Places I've worked used silicone oil for pressure sensor calibration and tubing fill (no air bubbles). I talked to a DuPont 30year chemical engineer and he warned me that silicone contamination is a huge problem for many facilities. It somehow stays in the air and upsets other glues, potting compounds etc. and even attacks electronic components, absorbed into resistors. This is what he told me causes many problems with their products- the customer's manufacturing plant is contaminated.

Reminds me of repairing CNC machines, the glycol coolant mist contaminates all the electronics and relays, switch contacts. Everything reads 1MEG.

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