Another EMC resource
from EMC Standards

9 - Suppressing electro-mechanical devices - Updated Jan 2021

emc14bs v2.3

Helping you solve your EMC problems

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Module 9. Suppressing electromechanical devices

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Change Record: v2.2 to v2.3, Jan 2021

- **Safety note added to all slides, with some re-formatting where needed**
- **Slide 9.1.3 corrected – air gap for 1kV breakdown 0.1mm (instead of 1mm) and minimum air breakdown of 340V added**
- **Slide 9.1.4 – text improved**
- **Slide 9.5.3 – text improved**
- ***New slide 9.5.4 added – on build-up of conductive dusts***
- **Slide 9.6.2 – text improved**
- **Slide 9.8.2 (References) – improved and updated**

emc14bs v2.3 **All safety requirements must be applied**, not necessarily covered in these slides CCC

Good EM (electromagnetic) Engineering, and De-Risking new projects

- **Good EM engineering is cost-effective SI, PI, EMC design: well-proven to save time & money in all lifecycle stages, helping increase profits & reduce financial risks…**
  - **for all products, equipment, vehicles, systems, installations; etc., of any size, in all applications…**
    see www.emcstandards.co.uk/testimonials *and Module 1*
    (especially 1.15, which is also in Webinar 1c; and 1.16 – also in Webinar 1d)
- **Our courses provide good EM Engineering guides that can be used initial design checklists to De-Risk new projects: *any that can't or won't be followed identify a project risk!***
  also see Module 1, section 1.16 (also in Webinar 1d)
  - **to adapt λ-based design guidelines to different applications and/or different EMC test standards: see Module 1, section 1.18** *(also in Webinar 1d)*

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For safety requirements – see our courses on designing for safety compliance

Keep up to date with new versions of this course module!
Visit: www.emcstandards.co.uk/emc-for-products-equipment2

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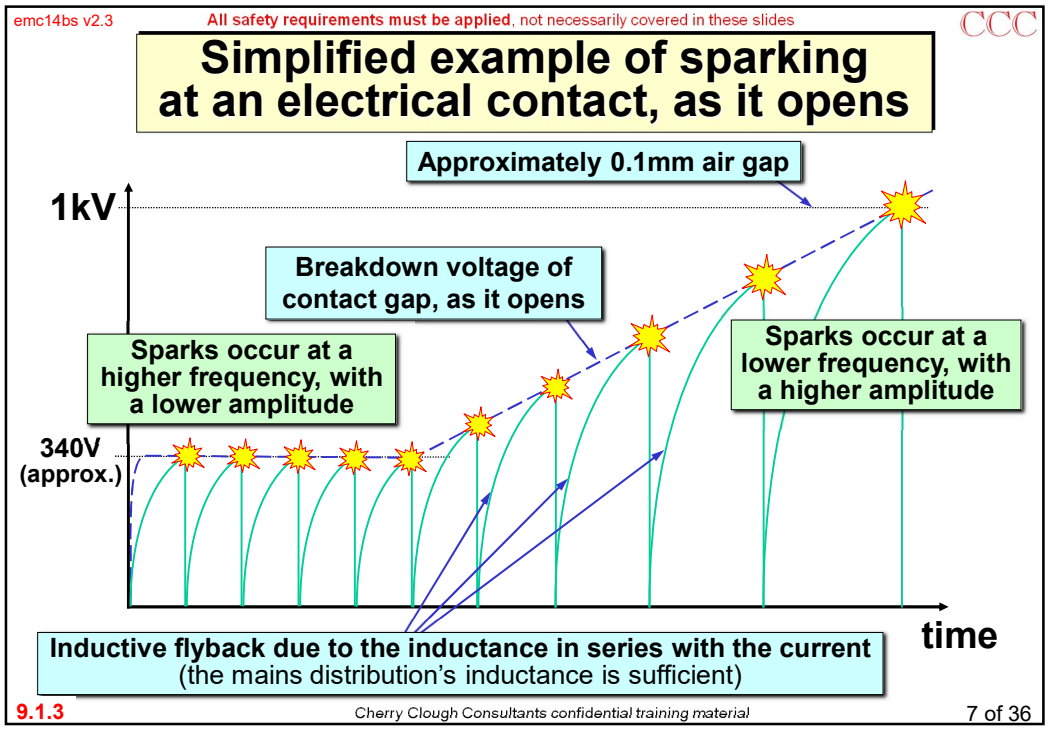
9. Suppressing electromechanical devices

9.1

Emissions caused by arcs and sparks

Introduction to arcs and sparks

- **When a contact opens the current can't change instantly because of the inductance in the circuit…**
  - **inductive energy is stored in any conductor (e.g. mains supply distribution and long DC cables)…**
  - **also stored in all coils and windings (solenoids, transformers, motor windings, etc.)**
- **The resulting voltage flyback breaks down the contact's air gap while it tries to maintain the current flow**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All safety requirements must be applied, not necessarily covered in these slides
CCC
Simplified example of sparking at an electrical contact, as it opens
Approximately 0.1mm air gap
1kV
Breakdown voltage of contact gap, as it opens
Sparks occur at a higher frequency, with a lower amplitude
Sparks occur at a lower frequency, with a higher amplitude
340V (approx.)
time
Inductive flyback due to the inductance in series with the current
(the mains distribution's inductance is sufficient)
9.1.3
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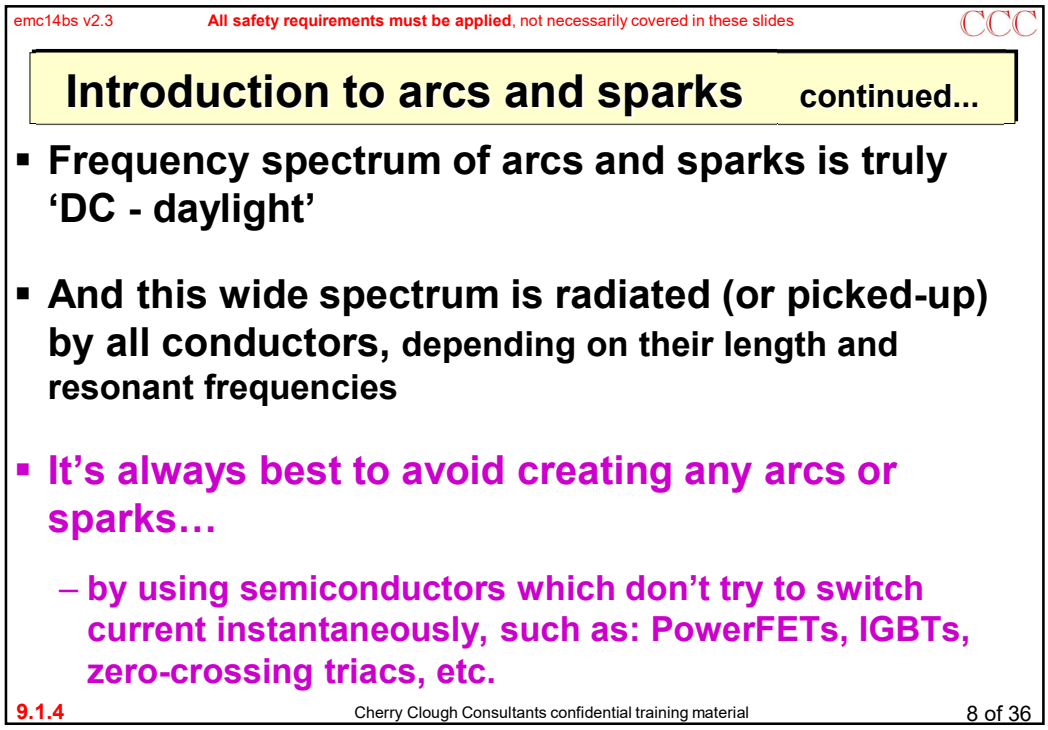
emc14bs v2.3
All safety requirements must be applied, not necessarily covered in these slides
CCC
Introduction to arcs and sparks continued...
▪ Frequency spectrum of arcs and sparks is truly 'DC - daylight'
▪ And this wide spectrum is radiated (or picked-up) by all conductors, depending on their length and resonant frequencies
▪ It's always best to avoid creating any arcs or sparks…
– by using semiconductors which don't try to switch current instantaneously, such as: PowerFETs, IGBTs, zero-crossing triacs, etc.
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9. Suppressing electromechanical devices

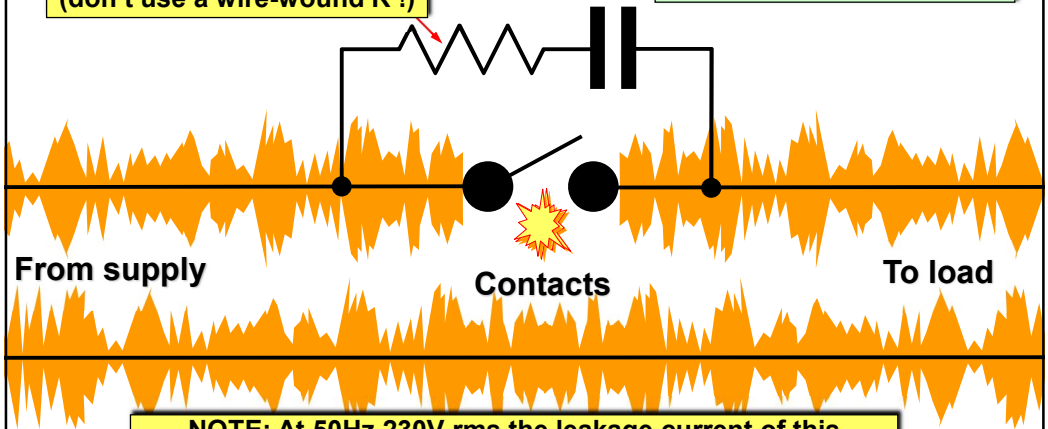
9.2

Suppressing electromechanical contacts

Snubbers for contact gaps

Popular style RC snubber typically 100Ω + 100nF (don't use a wire-wound R !)

2 or more switched poles need a snubber for each



NOTE: At 50Hz 230V rms the leakage current of this snubber circuit is 7.5mA rms: *a possible safety hazard*