

# DURAKOOL®

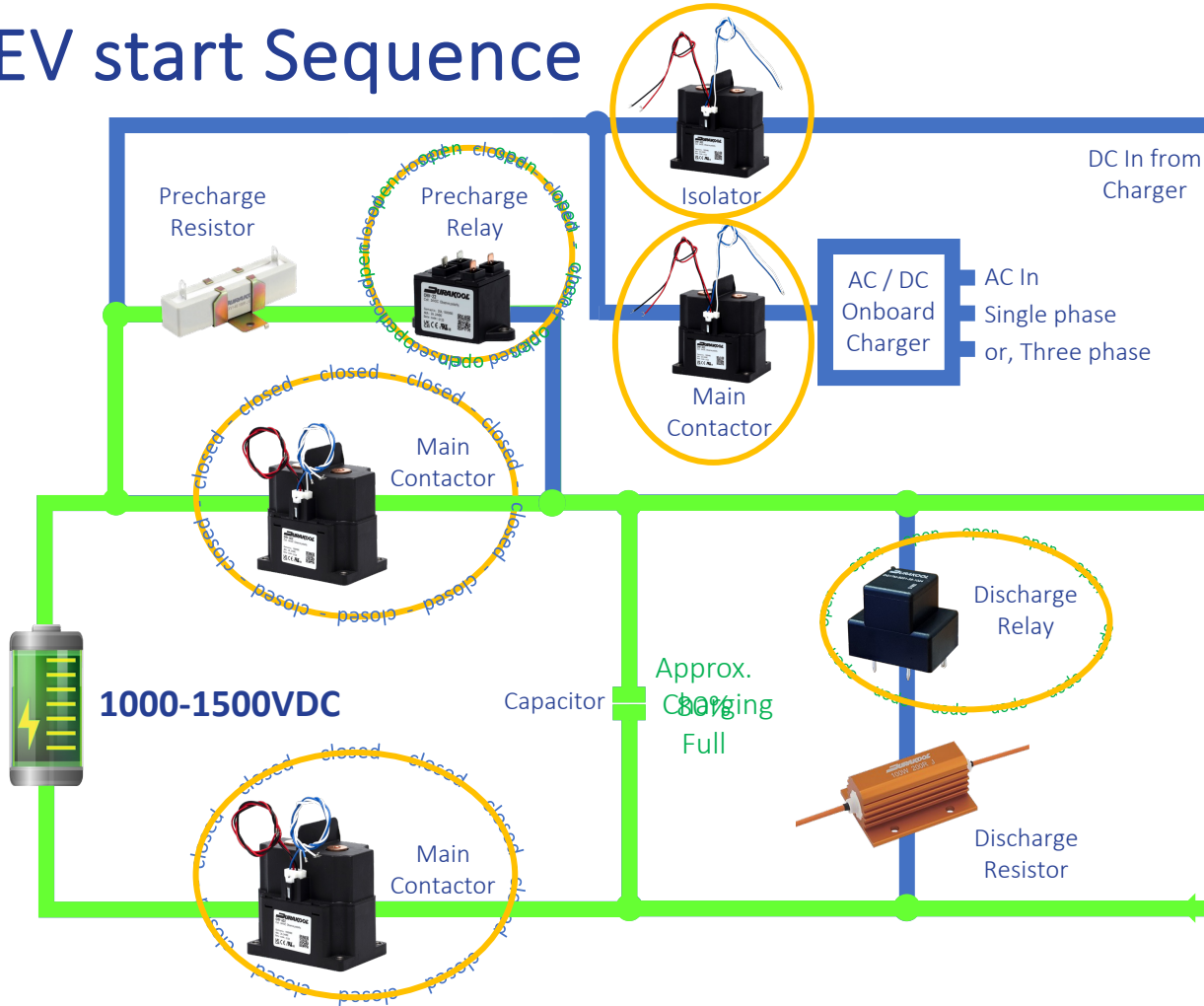
## Designing the optimal switch for your HV battery

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Durakool Product Manager  
Göteborg, September 2023



DURAKOOL®

# EV start Sequence







About

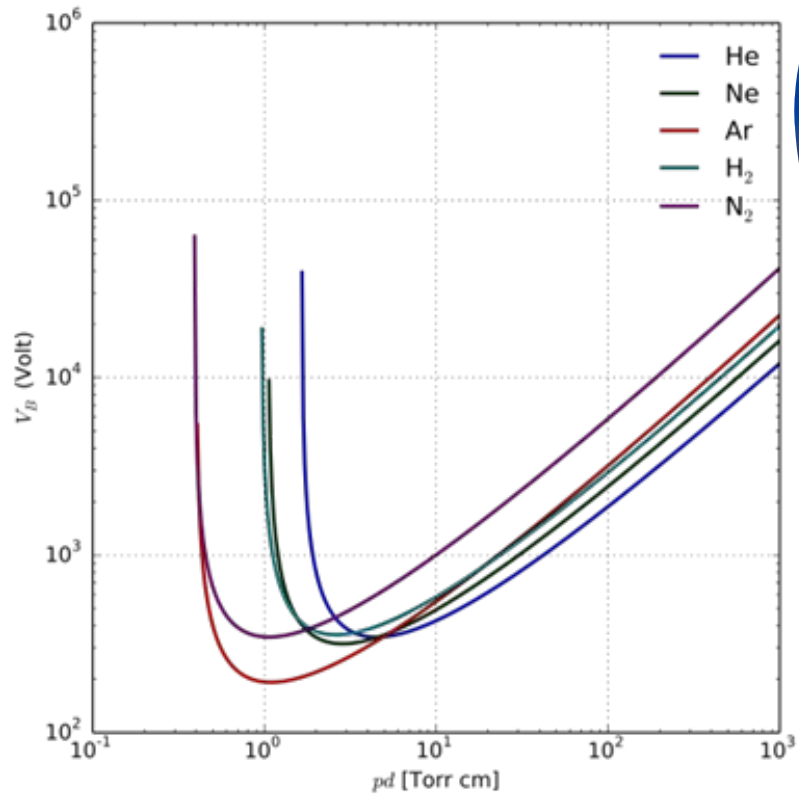
**DURAKOOL®**



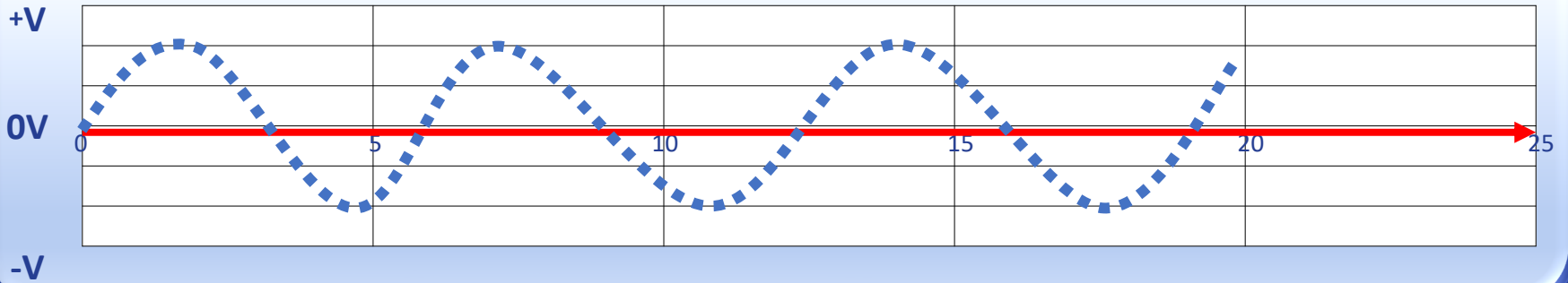
So, what are the challenges?



# Paschen's law

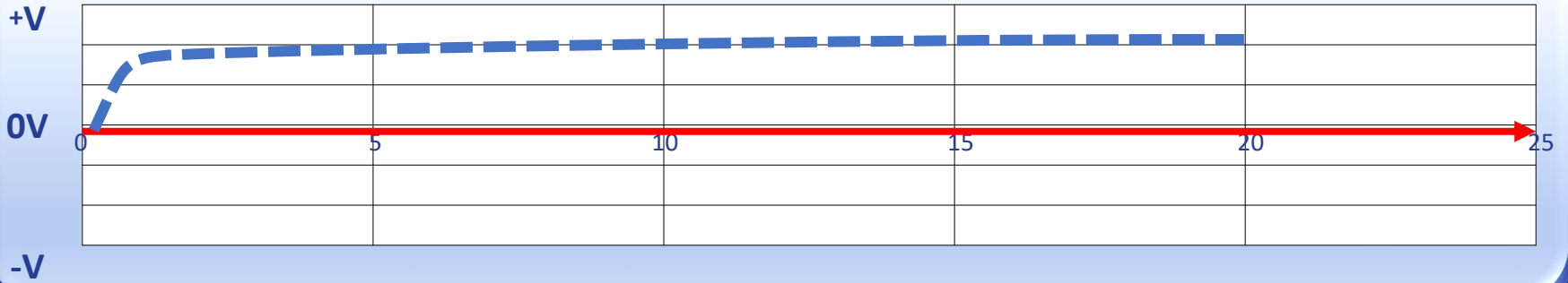


## AC Sine Wave



# Switching AC voltages

## DC Sine Wave

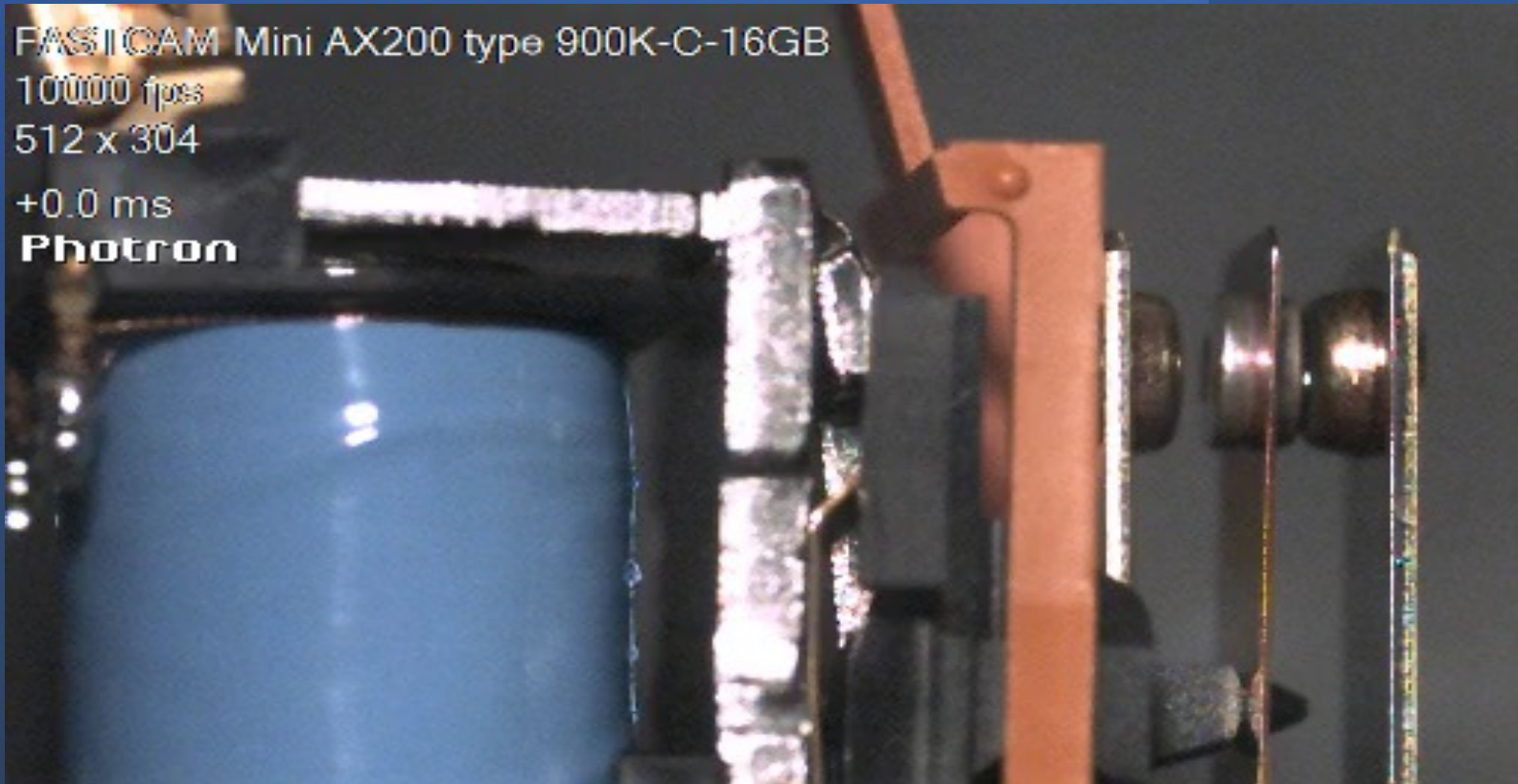


Switching DC voltages



# Contact bounce

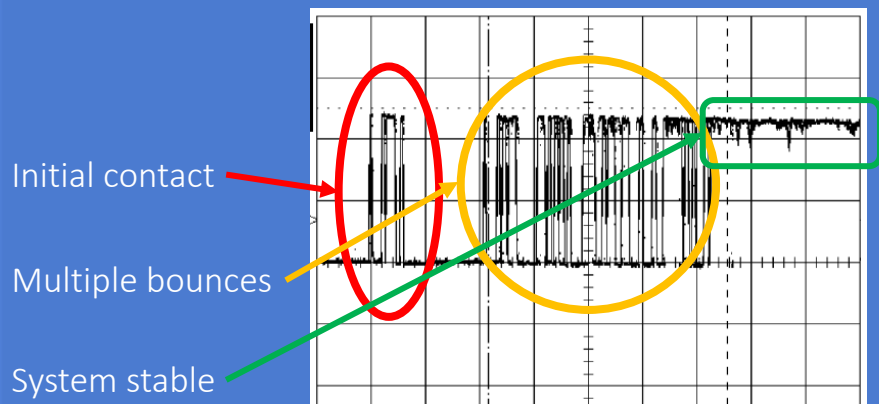
FASTICAM Mini AX200 type 900K-C-16GB  
10000 fps  
512 x 304  
+0.0 ms  
**Photron**



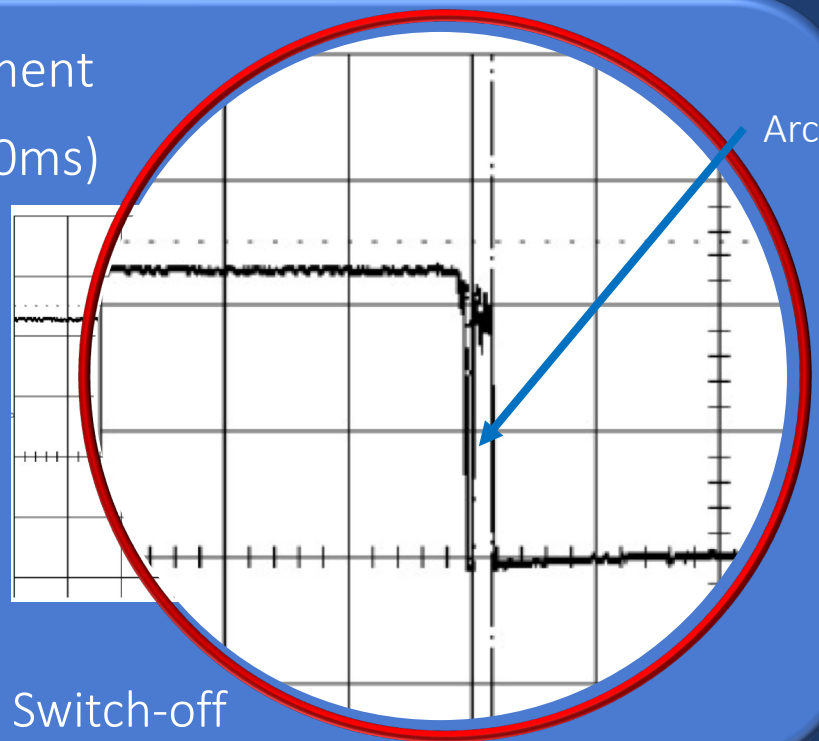
# bounce

Contact bouncing is the most critical moment

Multiple switching in a short time (0,7...10ms)



Switch-on



Switch-off

SPST-NO Relay - Picture shows the voltage characteristic for a resistive load

So, what happens if not  
controlled?

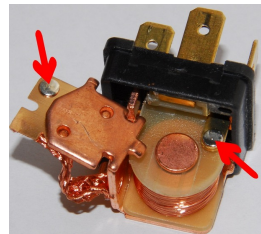


# The problem of DC switching

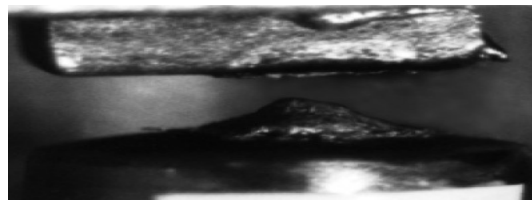
## Typical DC switching relay contact failures



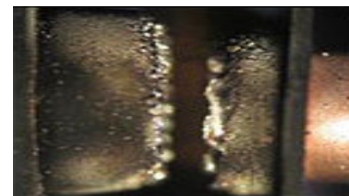
Contacts Weld



Contacts Micro-weld



Pit and Pip



Contact Abrasion

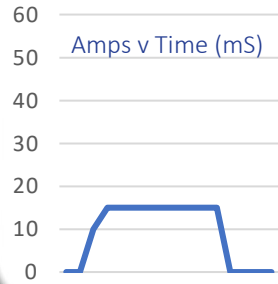
The background of the slide is a dark blue gradient with a complex, glowing circuit board pattern. The lines of the circuit are light blue and white, creating a sense of depth and movement. Small circular nodes are scattered throughout the circuit lines.

So, how do we solve the  
problem?

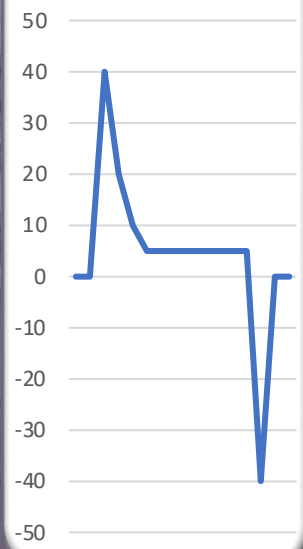
# Contact Materials

## Best suited for each type of load

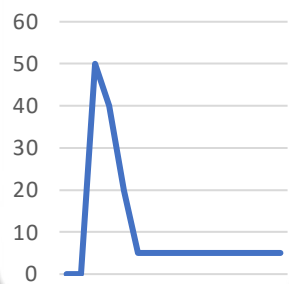
Resistive Load



Inductive Load



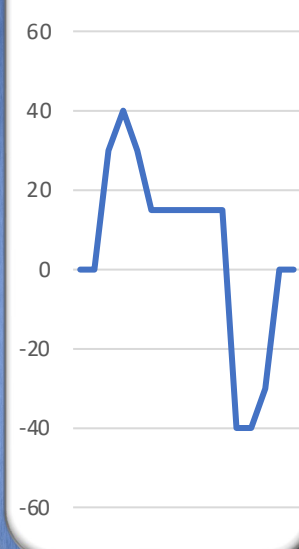
Lamp Load



Capacitive Load



DC Motor Load





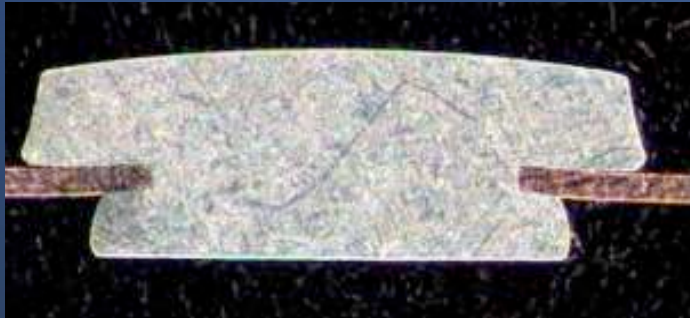
Section through a  
typical  
contact  
rivet

Good quality

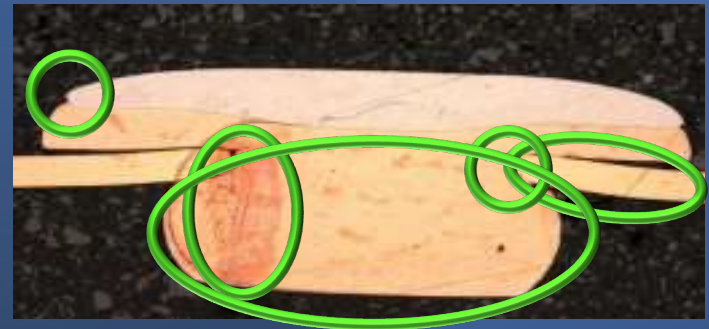


# Section through a typical contact rivet

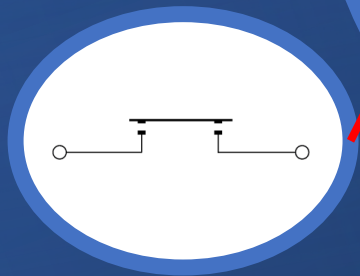
Good quality



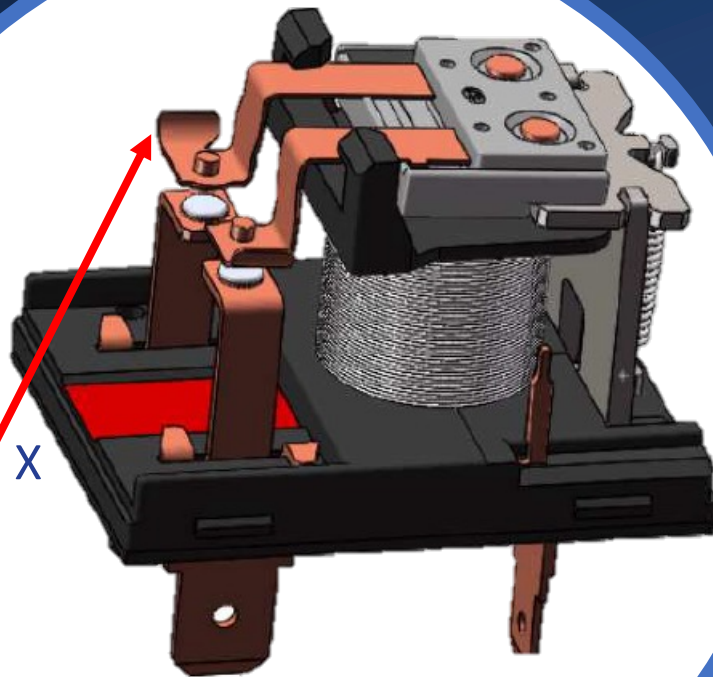
Poor quality



Elongated &  
shaped contacts



1 Form X



Internal structure of  
DE20



Arc ignition

Arc elongation

Arc quenching



Elongated & shaped contacts

# Using a magnet to solve the problem

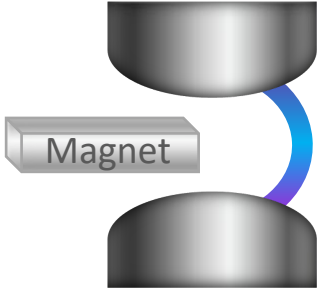
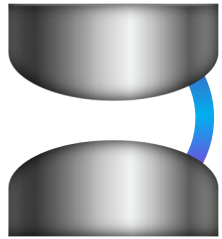
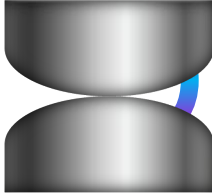
Contact  
Contacts closed

Contacts start to open & arc begins

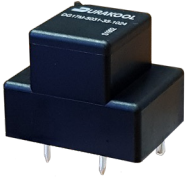
Contacts fully open arc does not go out

Contacts fully open, magnet pushes arc away, extinguishing the arc

Contact



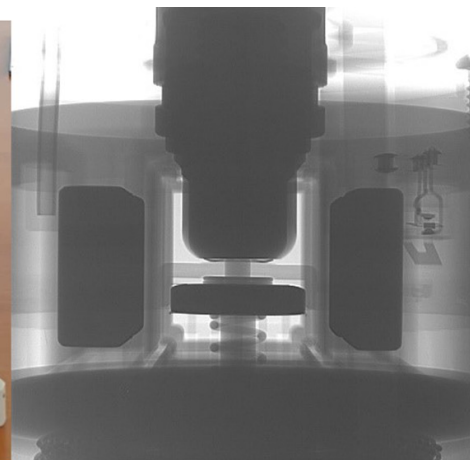
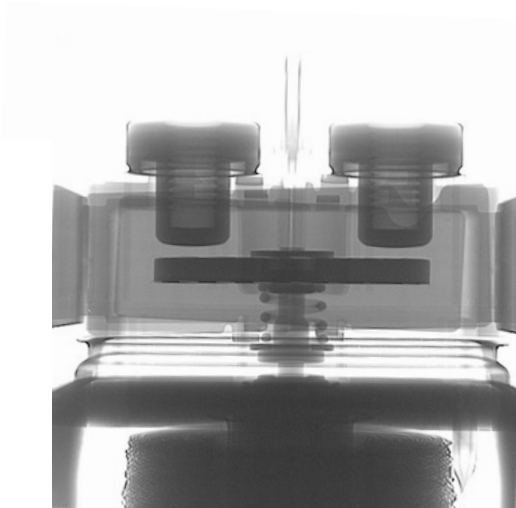
15A@450VDC



50A@48VDC



# Special gas filled chamber





# Not all solar panel installations are huge fields!

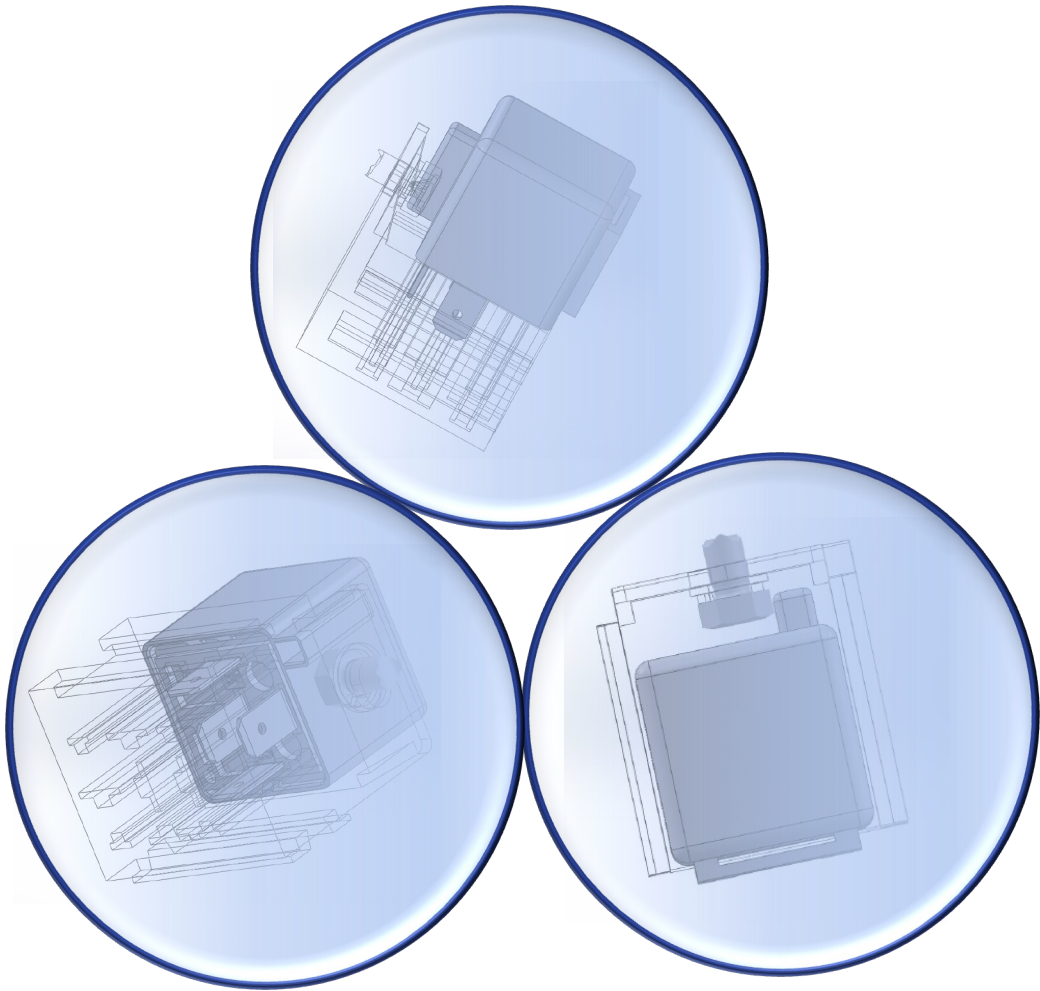


Photos: Renovagen



Not all  
EV's are  
cars!







# Thank you!



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