nedap
technology that matters

Power electronics do's and don'ts...

Tonnie Telgenhof Oude Koehorst
info@nedap-uv.com
www.nedap-uv.com

Power Components
Testing & EMC
Power Applications
Power Research

POWER ELECTRONICS 2017

20-06-17 - 1931 Congrescentrum Den Bosch

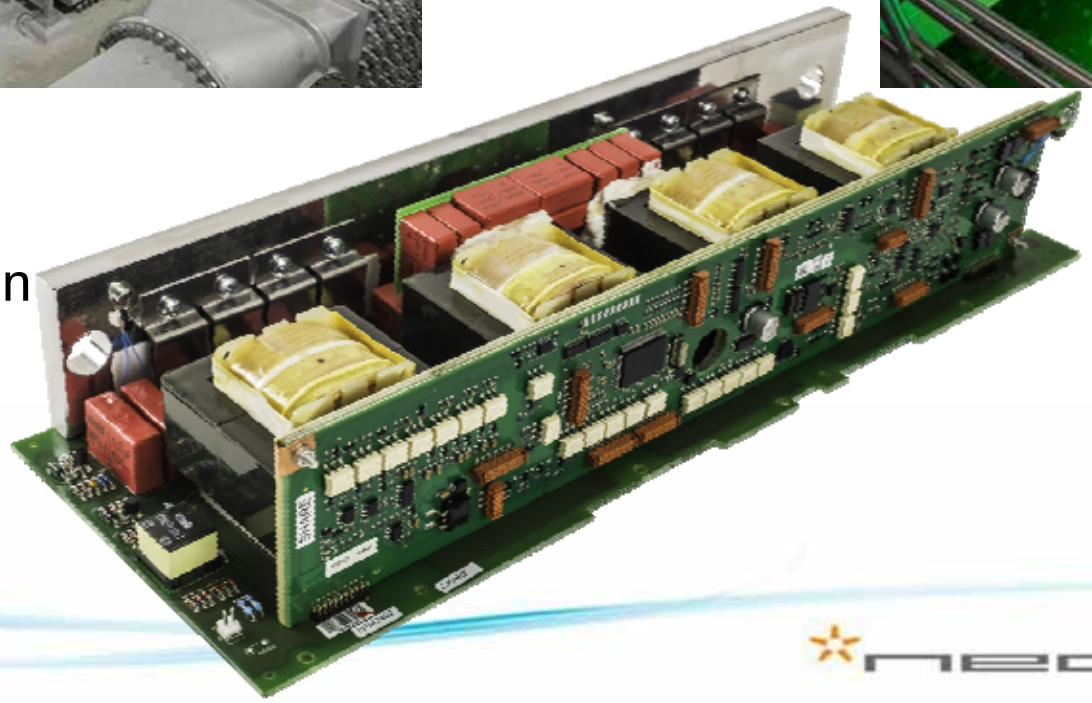
Do's and don'ts……

- Introductie
- "Externe" invloeden
- Software, Safety & Power Electronics
- Ontwerp overwegingen <> kosten
- Opvallende problemen

- 12 marktgroepen
- 775 medewerkers
- 186 miljoen omzet

Nedap **UV**

Drinkwater
New York
12000 lampen
2,7 MW



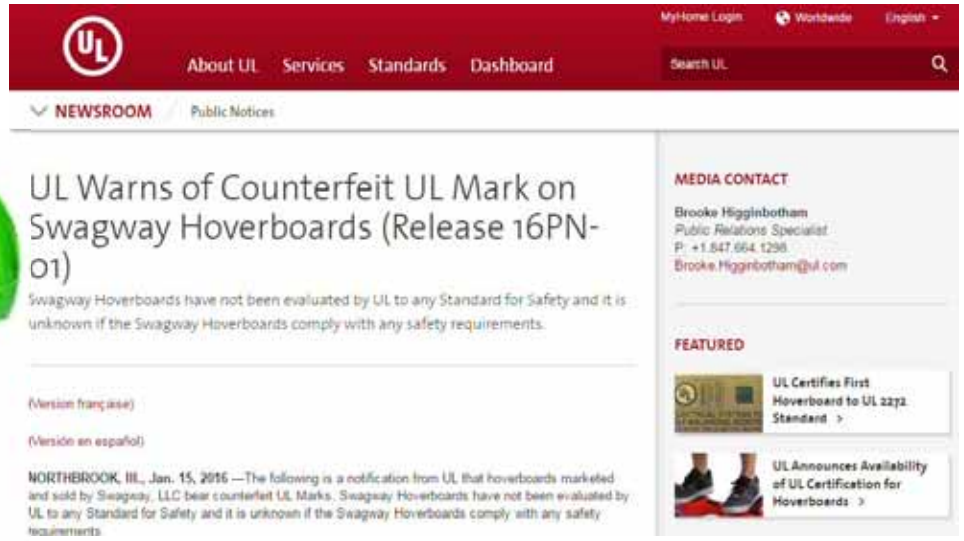
Afvalwater
Chicago
920 lampen
0,92 MW

nedap | light controls

2016

Veiligheid

Mogelijke claims



NOS Nieuws Sport Uitzendingen

Onderzoek naar ontploffende hoverboards

8 juni 2017 BINNENLAND

De Nederlandse Voedsel- en Warenautoriteit (NVVA) gaat onderzoek doen naar de brandveiligheid van hoverboards, gemotoriseerde tweewielige skateboards. Sinds maart heeft de NVVA vier meldingen gekregen over ontploffende hoverboards. De brand ontstond meestal tijdens het opladen.

Veilig laden Samsung……

nedap | light controls

Battery with inbuilt ‘fire extinguisher’ developed

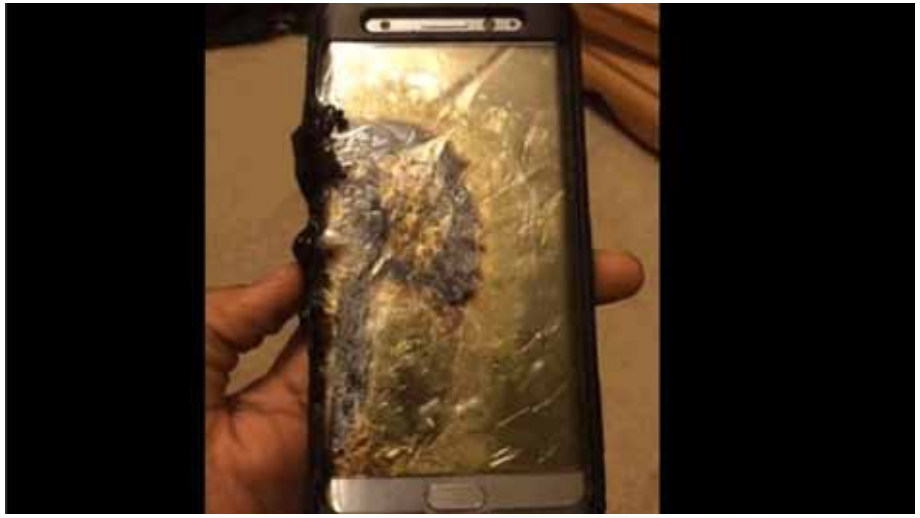
January 17, 2017

Researchers have designed a lithium-ion battery that contains a fire-extinguishing material, which is released if the battery gets too hot.

Flame retardant triphenyl phosphate (TPP) sits inside a shell within the electrolyte fluid. The shell melts when the temperature reaches 150°C (302°F), releasing the chemical compound.

In tests, battery fires were

extinguished in 0.4 seconds.

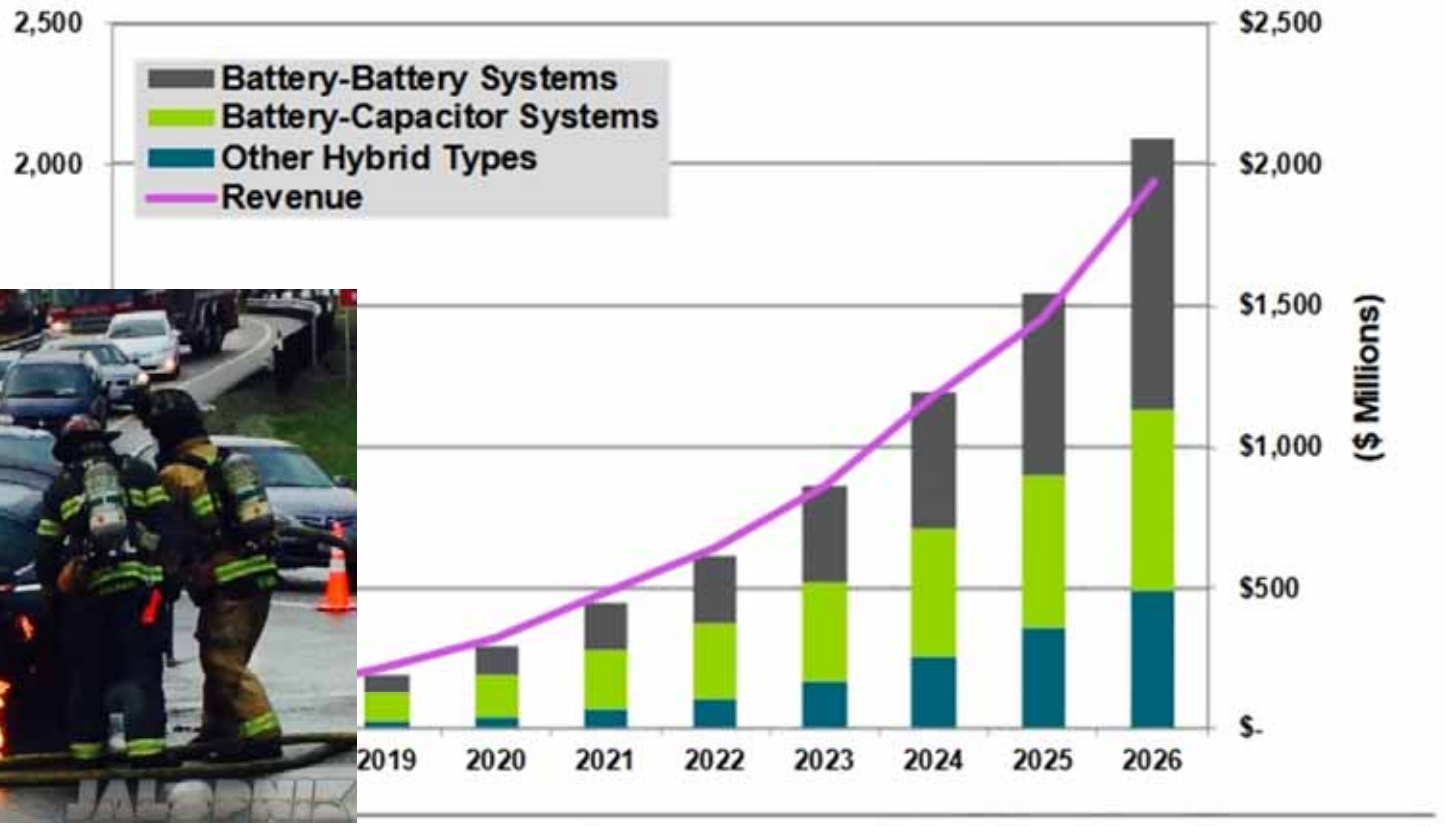


Safety standards and testing protocols for lithium-ion cells

Table 1: Summary of abuse tests found in international safety standards and testing protocols for lithium-ion batteries[3]

	UL					IEC		NEMA	SAE	UN	IEEE		JIS	BATSO
Test Criteria/Standard	**UL 1642**	**UL 2054**	**UL Subject 2271**	**UL Subject 2580**	**UL 2575**	**IEC 62133**	**IEC 62281**	**C18.2M, Pt2**	**J2464**	**Pt.III,S 38.3**	**IEEE 1625**	**IEEE 1725**	**JIS C8714**	**BATSO 01**
External short circuit	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Abnormal charge	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Forced discharge	•	•	•	•	•	•	•	•	•	•	•	•	•	
Crush	•	•	•	•	•	•		•	•		•	•	•	•
Impact	•	•	•	•			•	•		•	•	•		
Shock	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Vibration	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Heating	•	•	•	•	•	•		•	•		•	•	•	
Temperature cycling	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Low pressure (altitude)	•		•	•	•	•	•	•		•	•	•	•	•
Projectile	•	•	•	•							•	•		
Drop			•	•		•	•	•					•	•
Continuous low rate charging						•							•	
Molded casing heating test								•						
Open circuit voltage								•						
Insulation resistance				•				•						
Reverse charge			•	•										
Penetration			•	•					•					
Internal short circuit test	•			•									•	

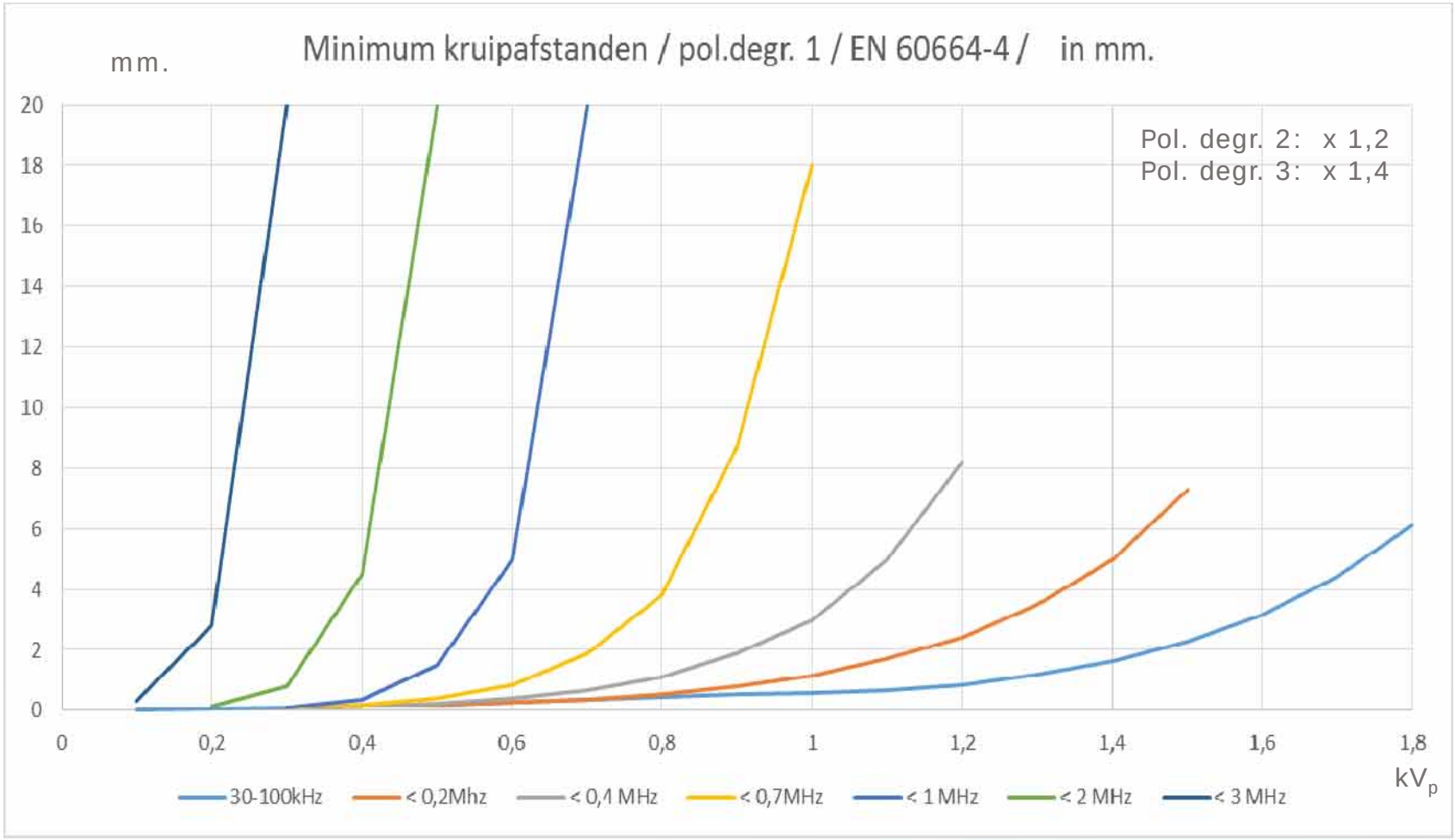
Chart 1.1 Installed HESS Power Capacity by Technology, World Markets: 2017-2026

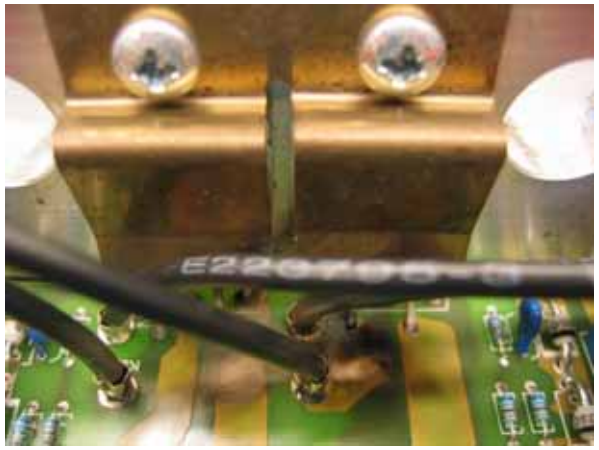


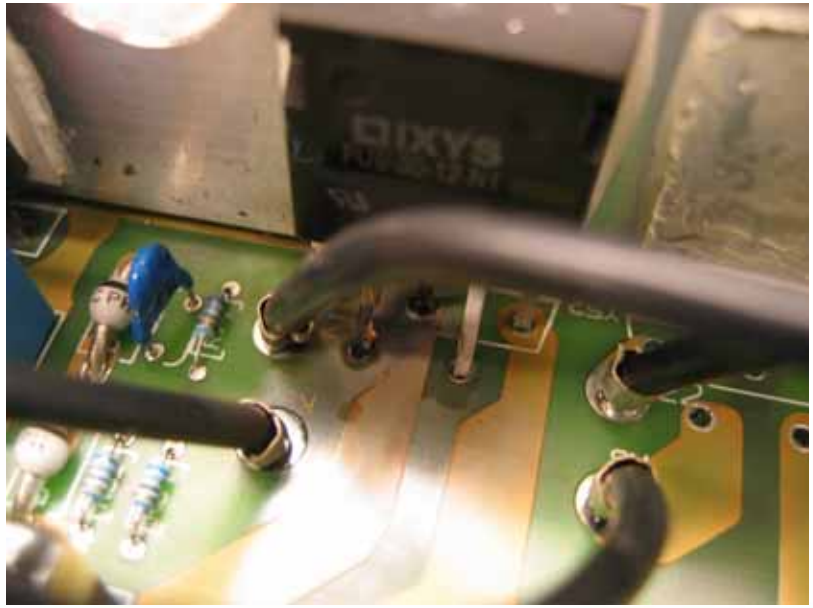
(Source: Navigant Research)

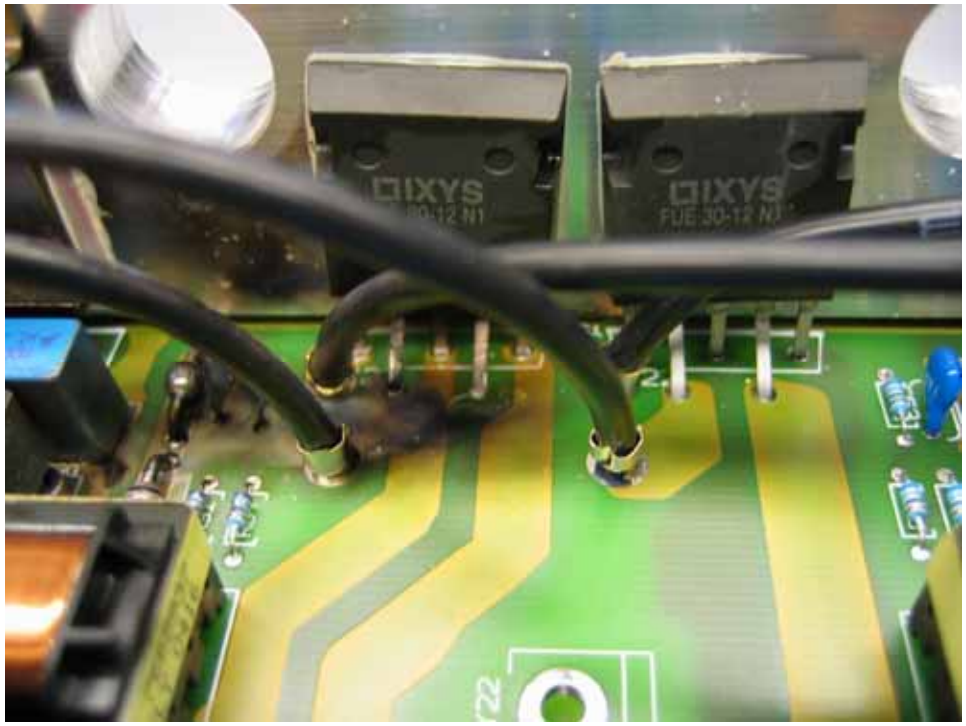
2016

Kruipweg







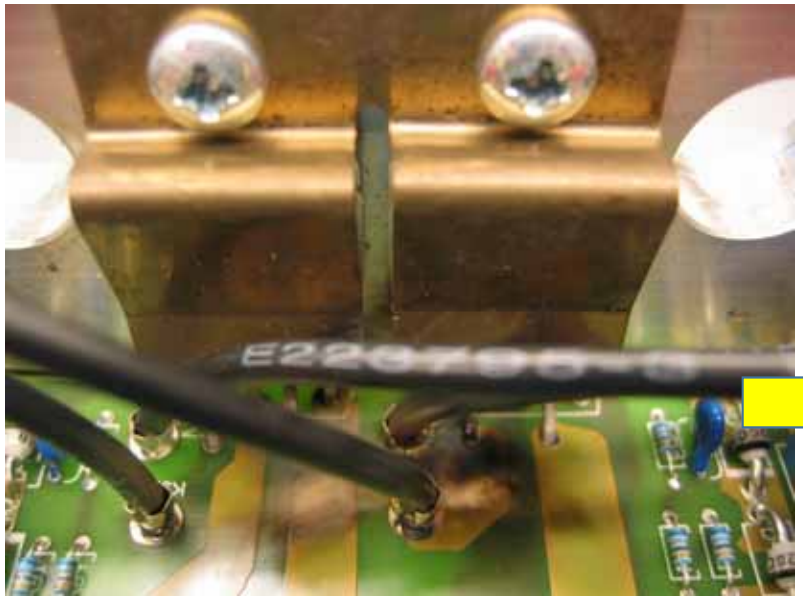


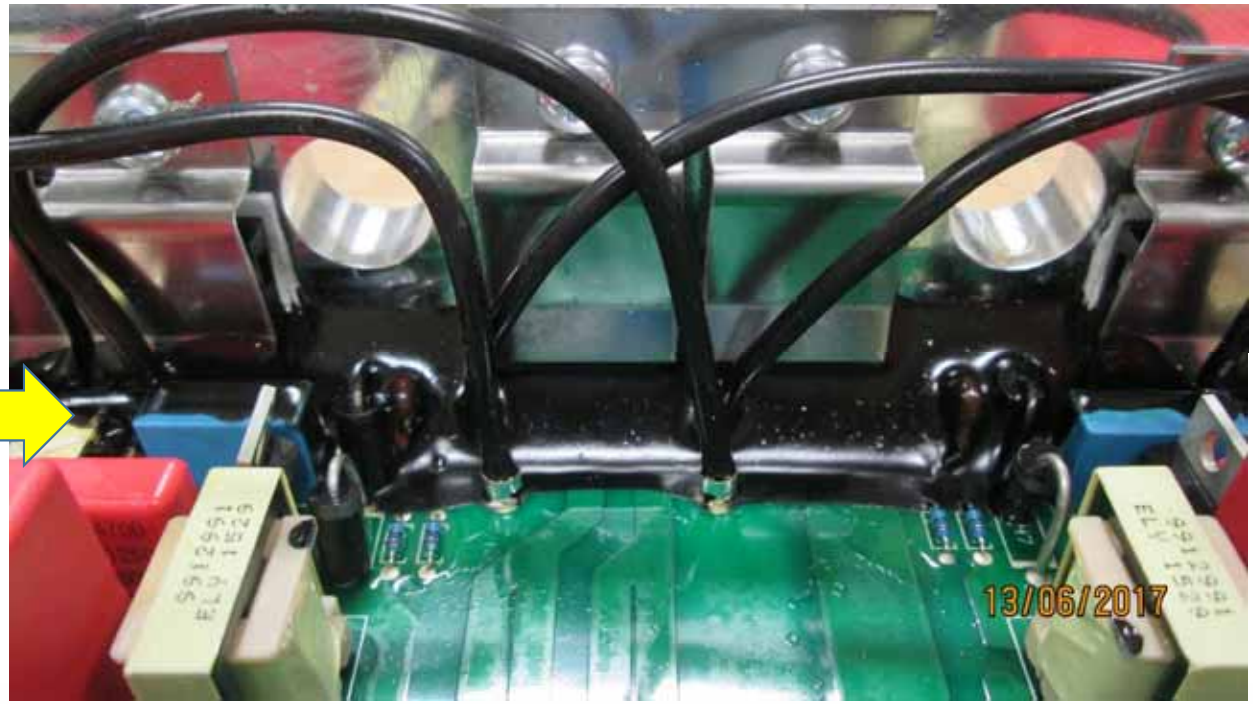
12kW PFC unit

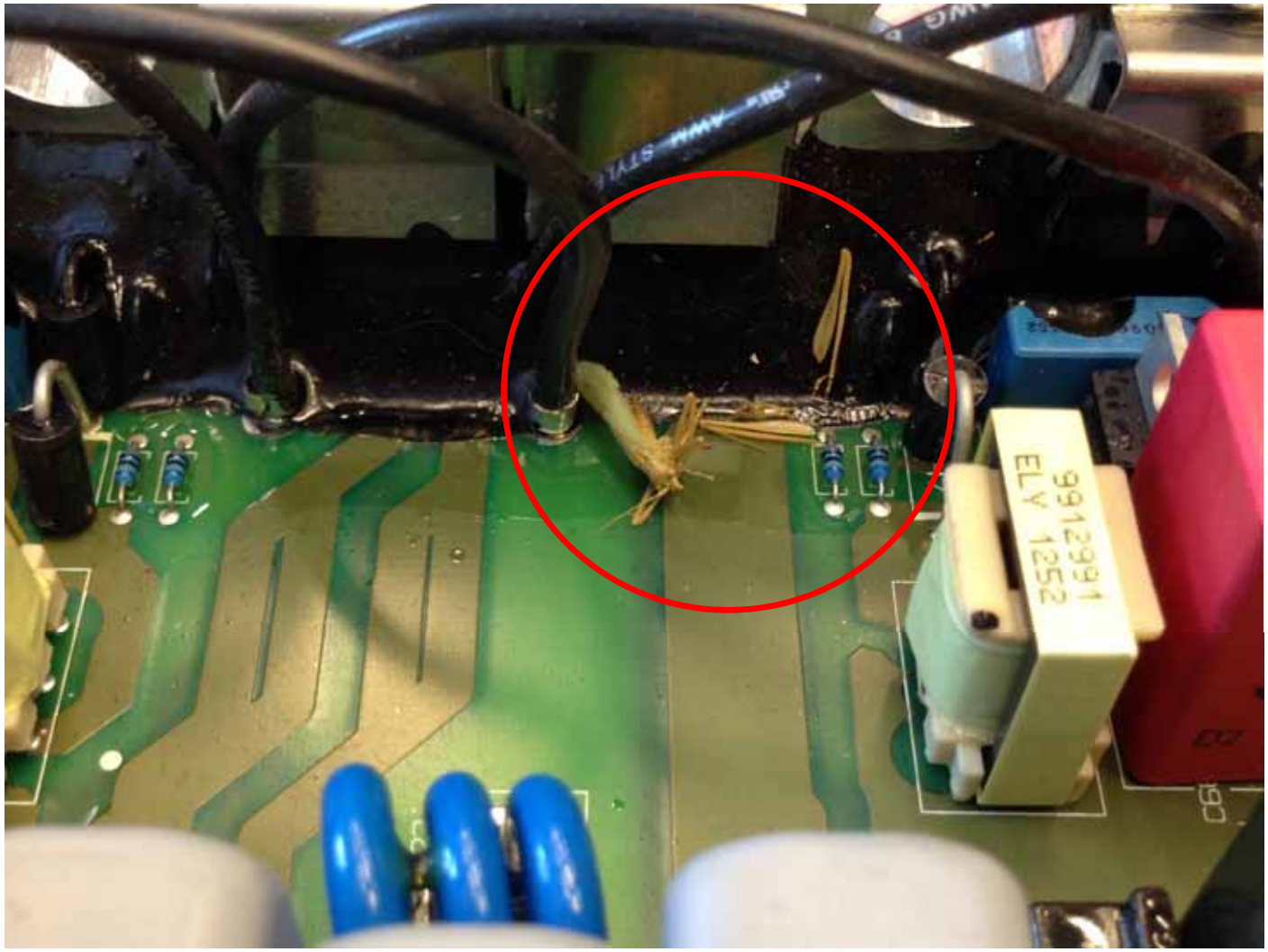
3 fase 360-526V in

+/- 400Vdc uit

Conformal coating & deels ingieten:





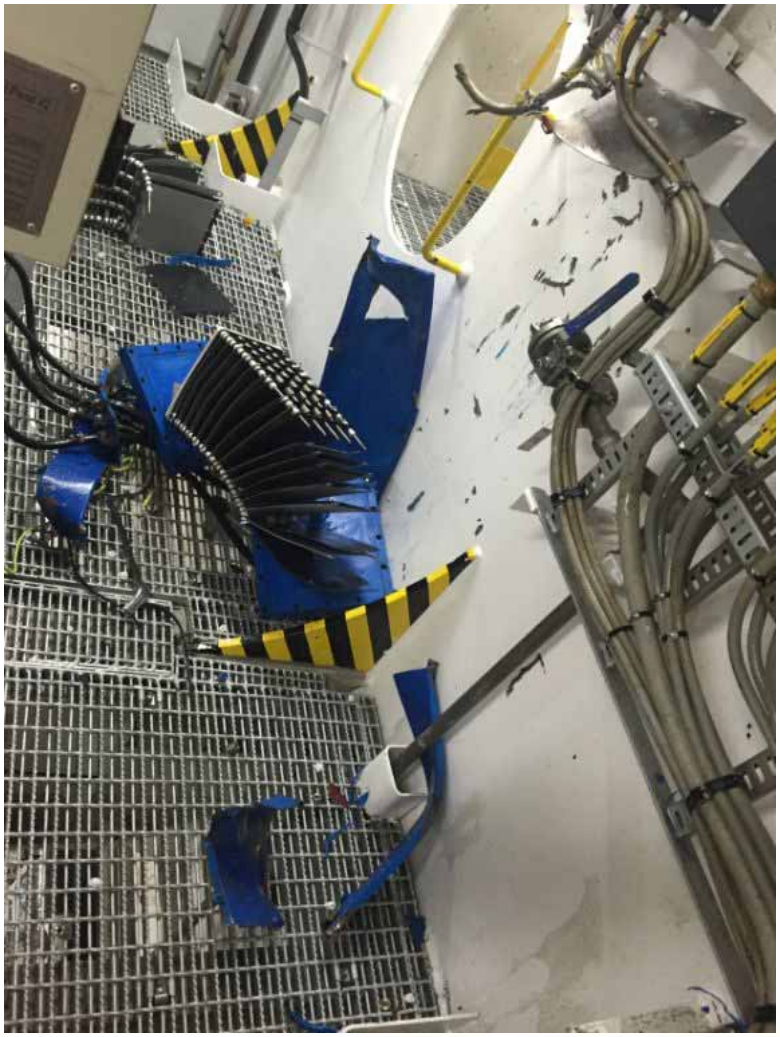

99129991
ELY 1252

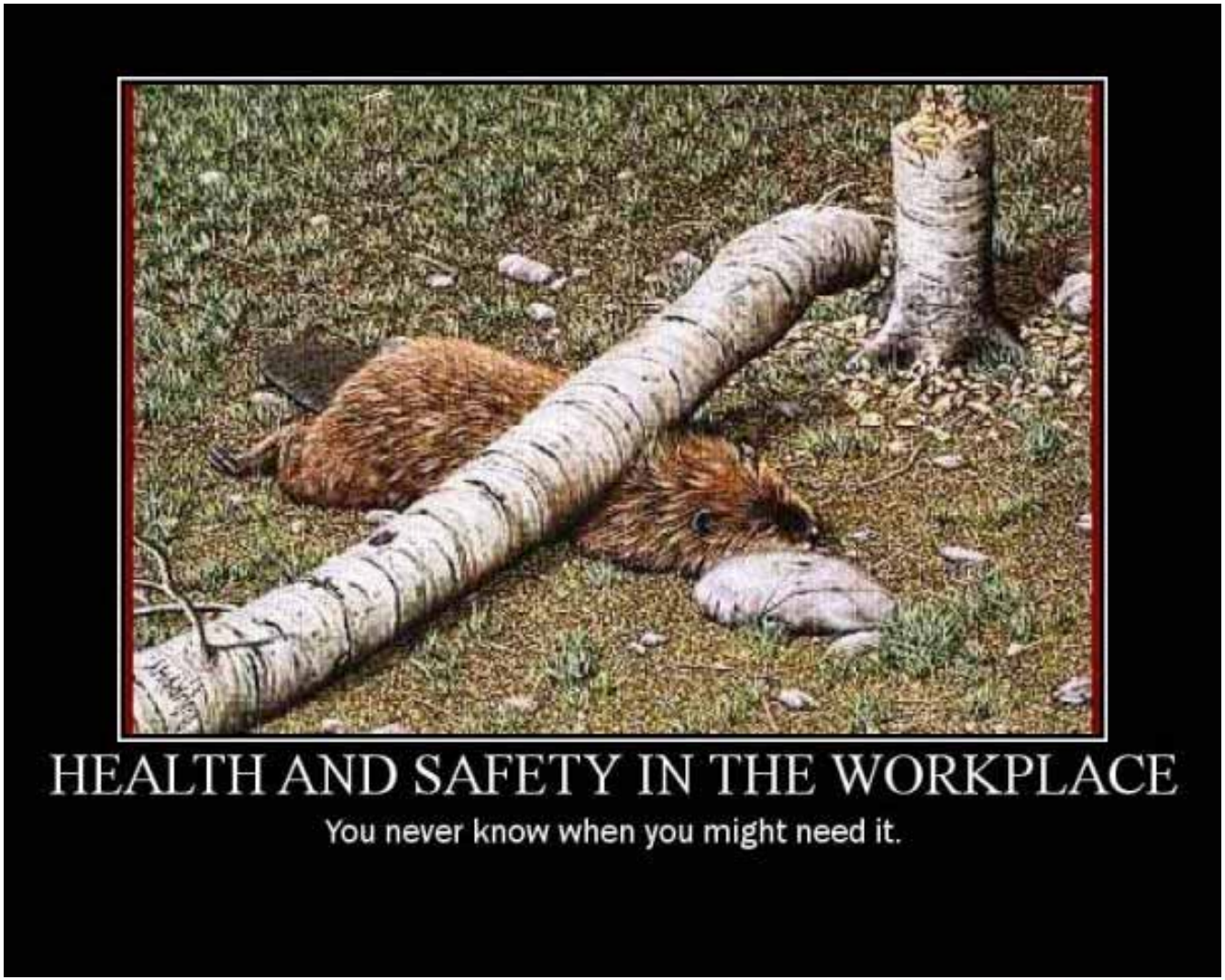
Software, Safety & Power Electronics……

- Flow chats
- Inzicht software (cursus C/C++)
- Leer van demoboards
- Scaled proto > 1% power voor debug en testen
- Check “human interface”
- SAFETY

Elektrolyse Unit
voor

Ballast Water



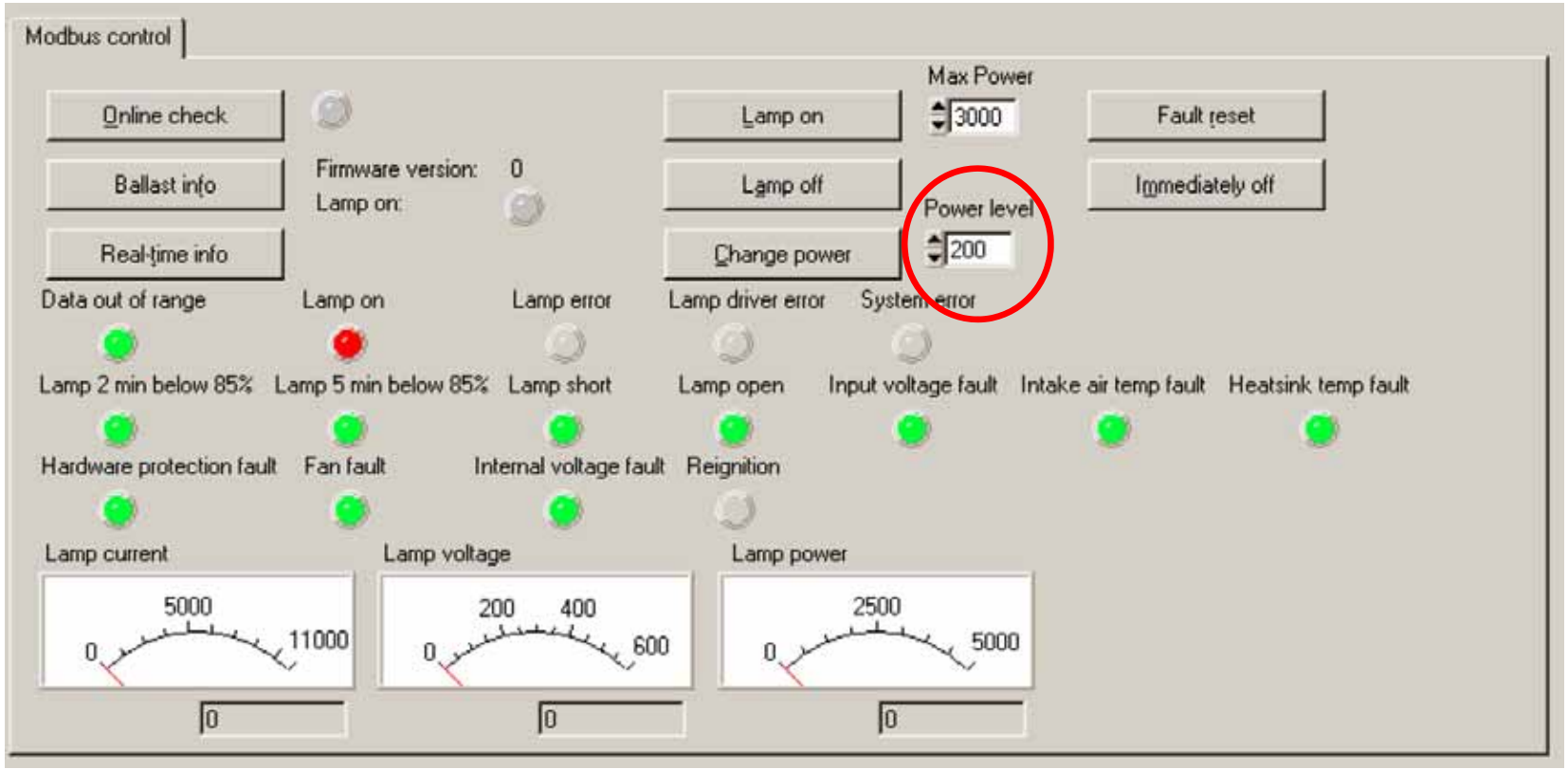

HEALTH AND SAFETY IN THE WORKPLACE
You never know when you might need it.

Characteristics of Safe Software

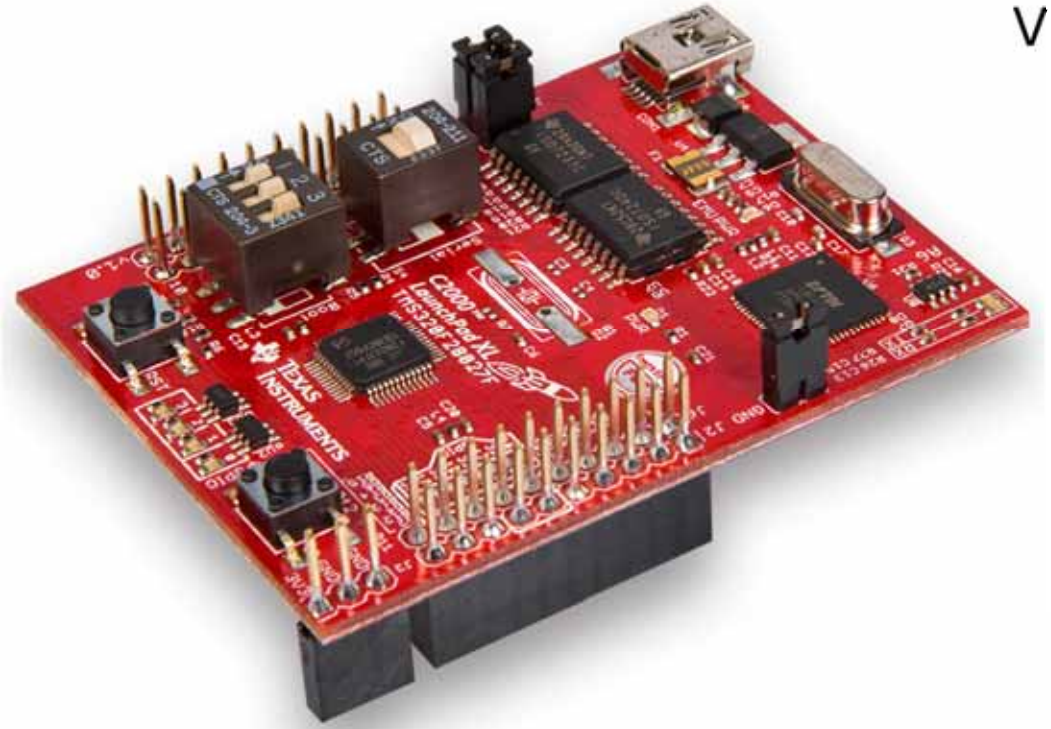
- Software is "safe" if…
  - It has features and procedures which ensure that it performs predictably under normal and abnormal conditions
  - The likelihood of an undesirable event occurring in the execution of that software is minimized
  - If an undesirable event does occur, the consequences are controlled and contained

"Software Safety and Reliability"
--D. Herrman


Error #507
DISPLAY MISSING

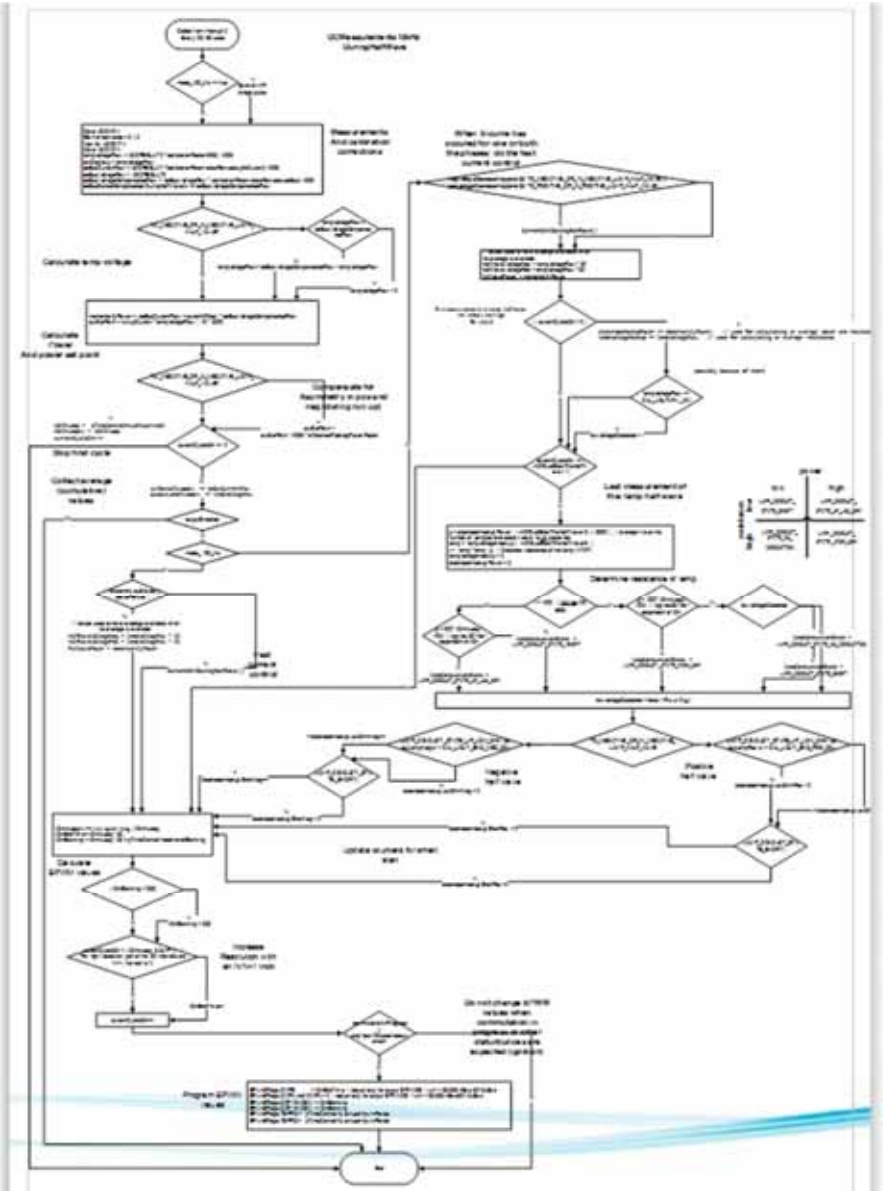


Power level in 200 stappen >> 100% = “200”.....

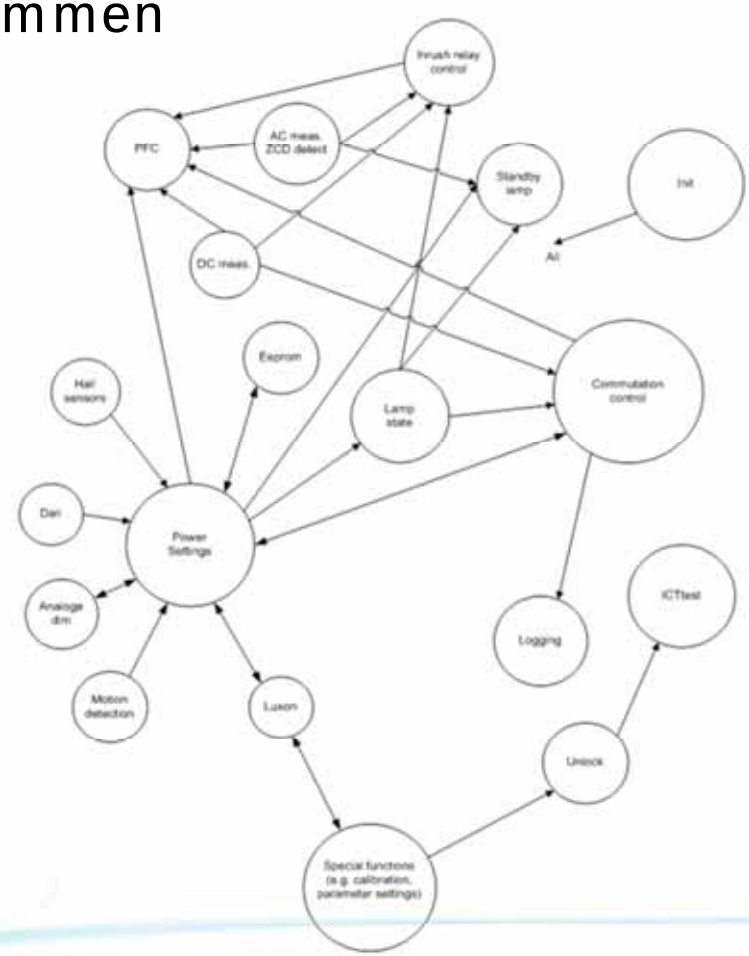


Voorbeeld TI C2000 LaunchPad XL

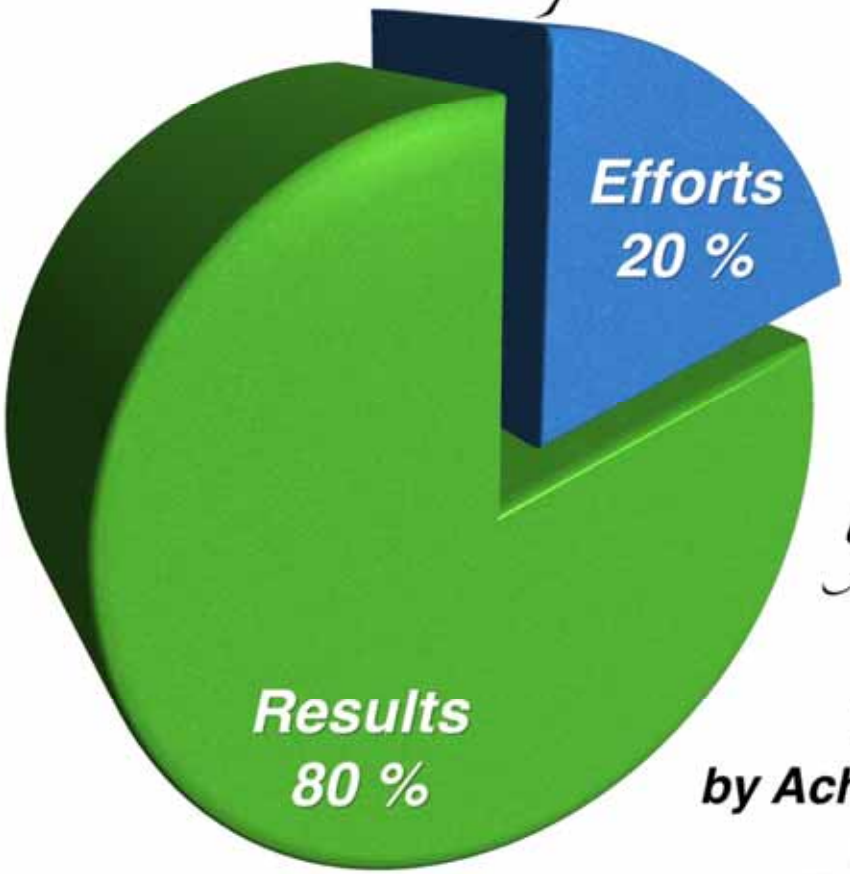
Zie websites microcontroller aanbieders



Zorg tijdig voor Flow charts / Context diagrammen



The Pareto Principle



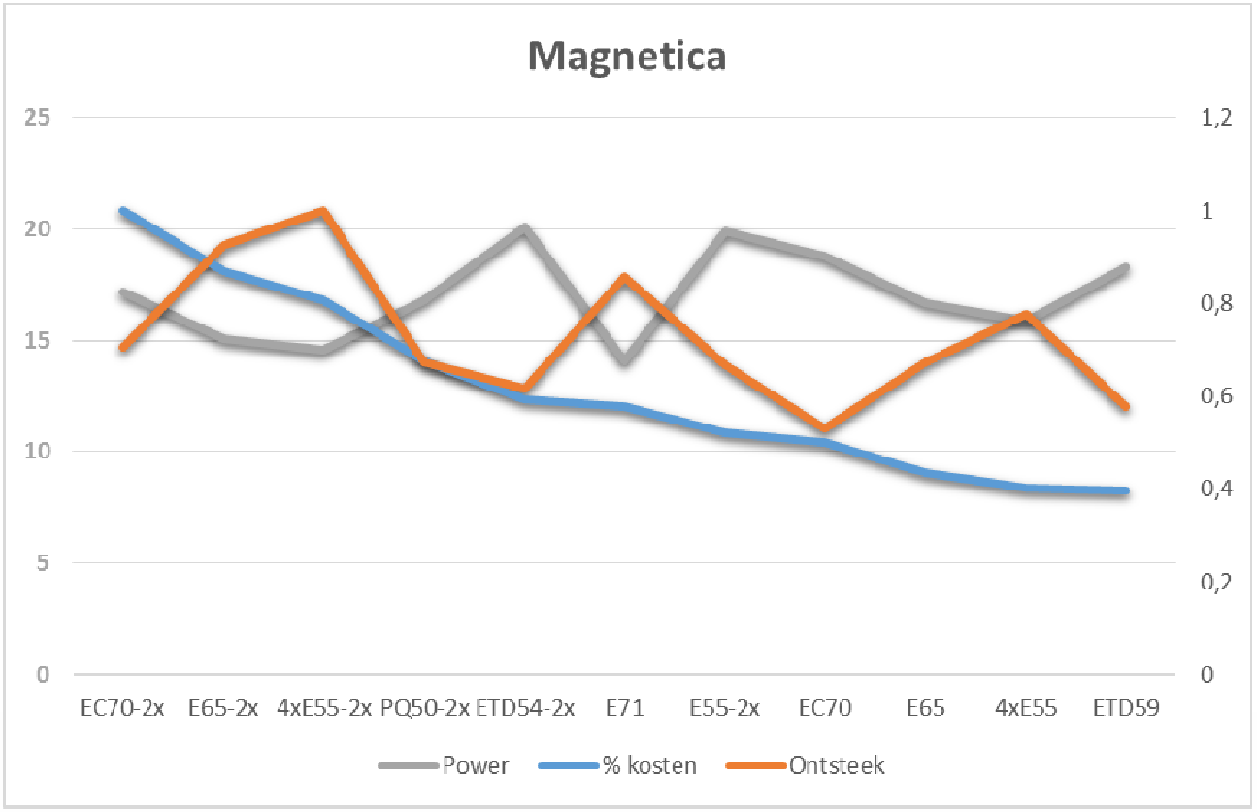
by Vilfredo Pareto

1848-1923

The Secret to Success
by Achieving More with Less

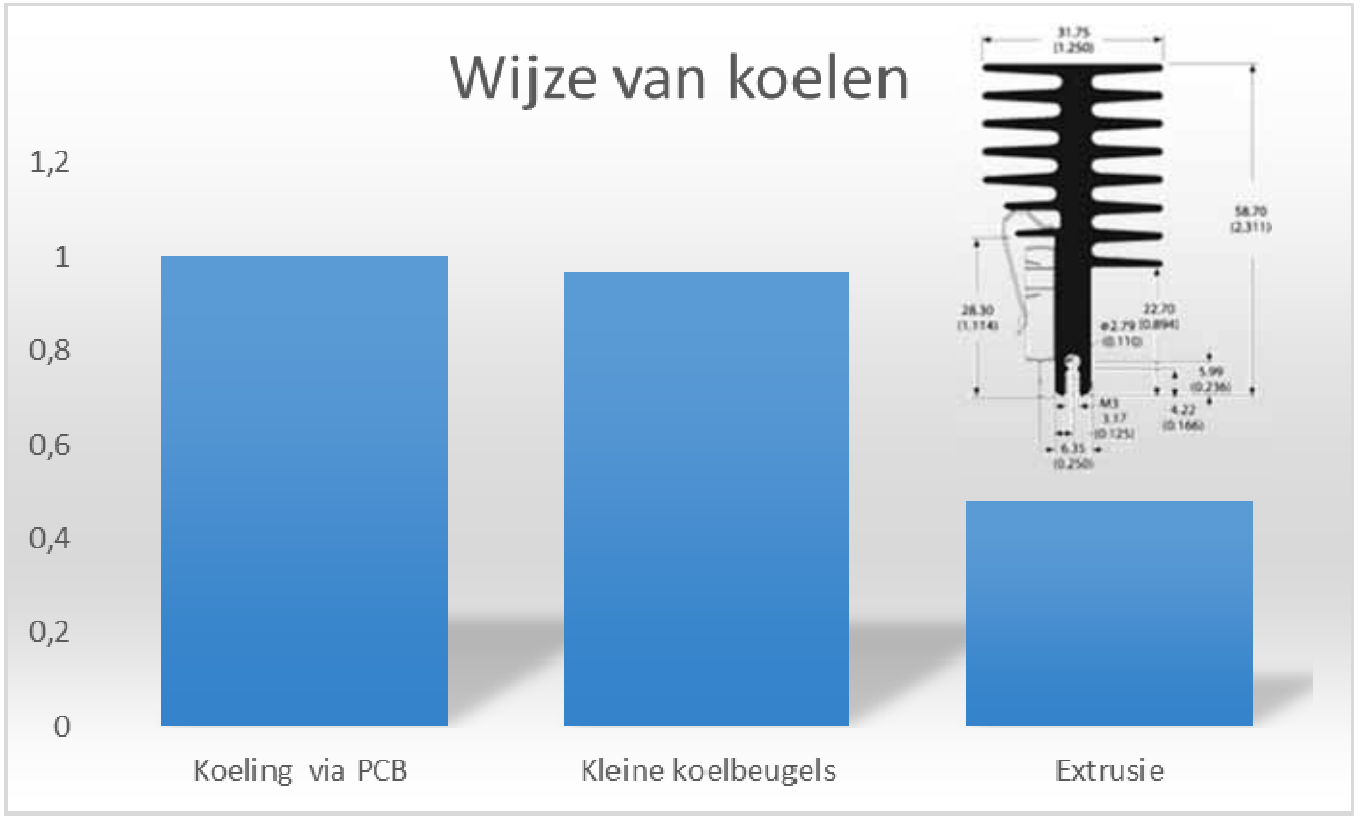
Nieuw ontwerp 3,5kW driver

Verliezen [W]



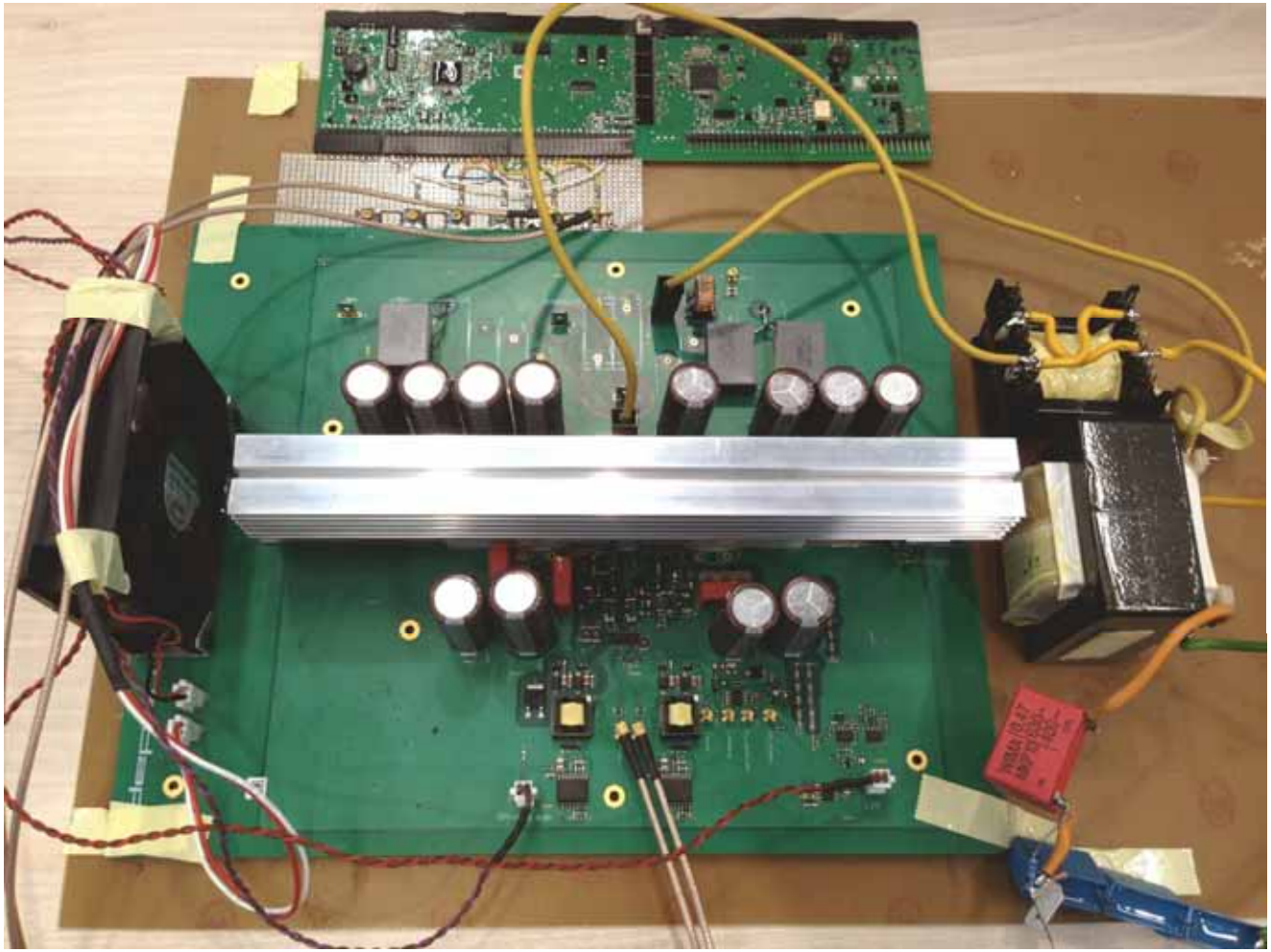
Kosten

Ontsteekspanning


Wijze van koelen
Kosten
1,2
1
0,8
0,6
0,4
0,2
0
Koeling via PCB
Kleine koelbeugels
Extrusie

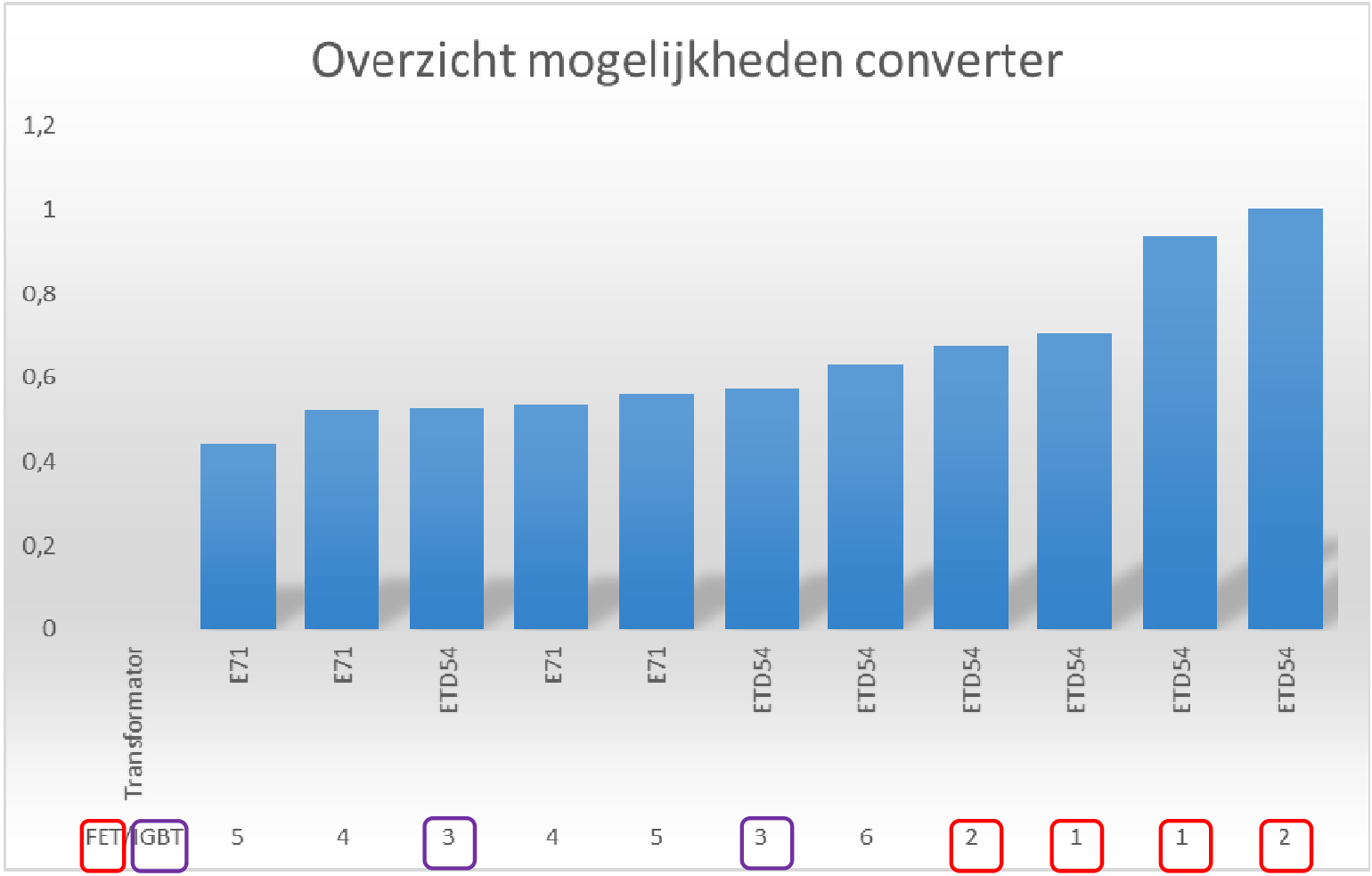
Test opstelling

- Fet / IGBT
- Koeling



Keuze:
SiC FET's
Halve brug

Kritisch:
Transformator temperatuur



Gate:
double pulse voltage -4..20V

Dcbus: 850Vdc

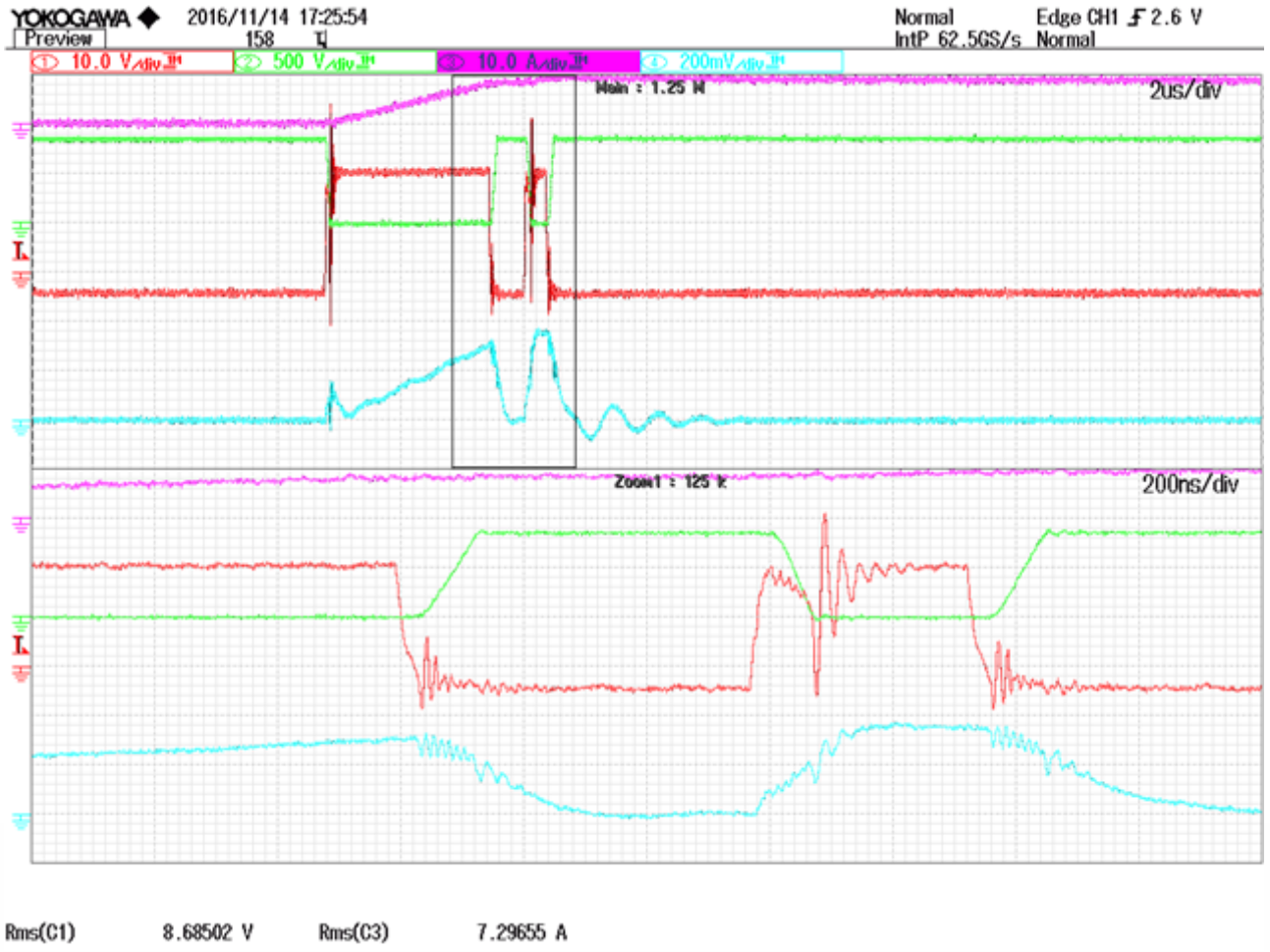
Ch1 U gate T8 10V/div.

Ch2 U drain T8 500V/div.

Ch3 I coil L5 halve brug–posbus (x2) 20A/div

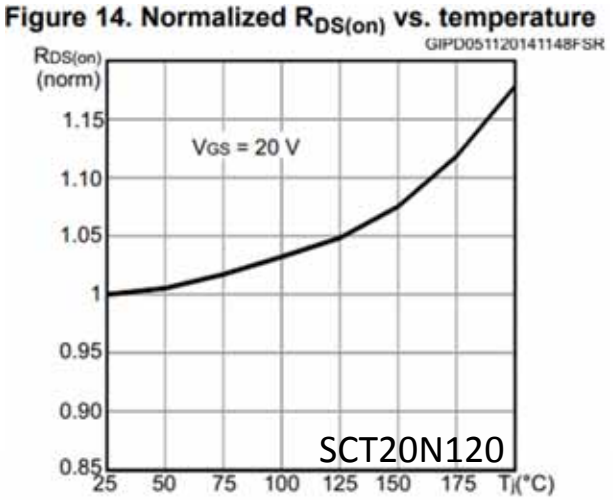
Ch4 I_{source} /U shunt R17 200mV/div

SCT30N120



Silicon Carbide FET's veelbelovend, maar.....

- Kleiner chip oppervlak > kleinere warmte capaciteit
- Voor min. aan-weerstand, gate > 20V en abs. rating is 22 /25V.
- Lay-out is kritischer !
- Let op EMC problemen
- Efficiency verbetering 0,6% >> + 72% in kosten



HS Diodes

2016

C4D02120E
Silicon Carbide Schottky Diode
Z-Rec™ Rectifier

V_{RRM} = 1200 V
I_F (T_C=135°C) = 4.5 A
Q_C = 11 nC

Features

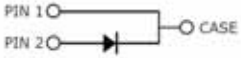
- 1.2kV Schottky Rectifier
- Optimized for PFC Boost Diode Application
- Zero Reverse Recovery Current
- High-Frequency Operation
- Temperature-Independent Switching Behavior
- Positive Temperature Coefficient on V_F

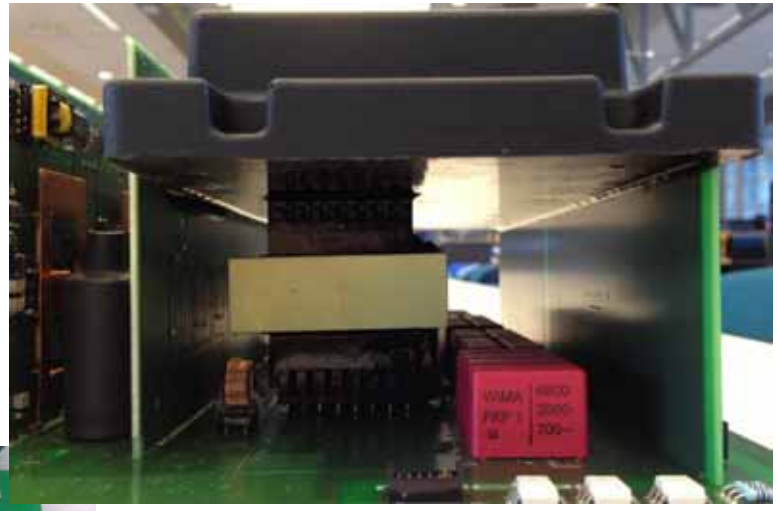
Benefits

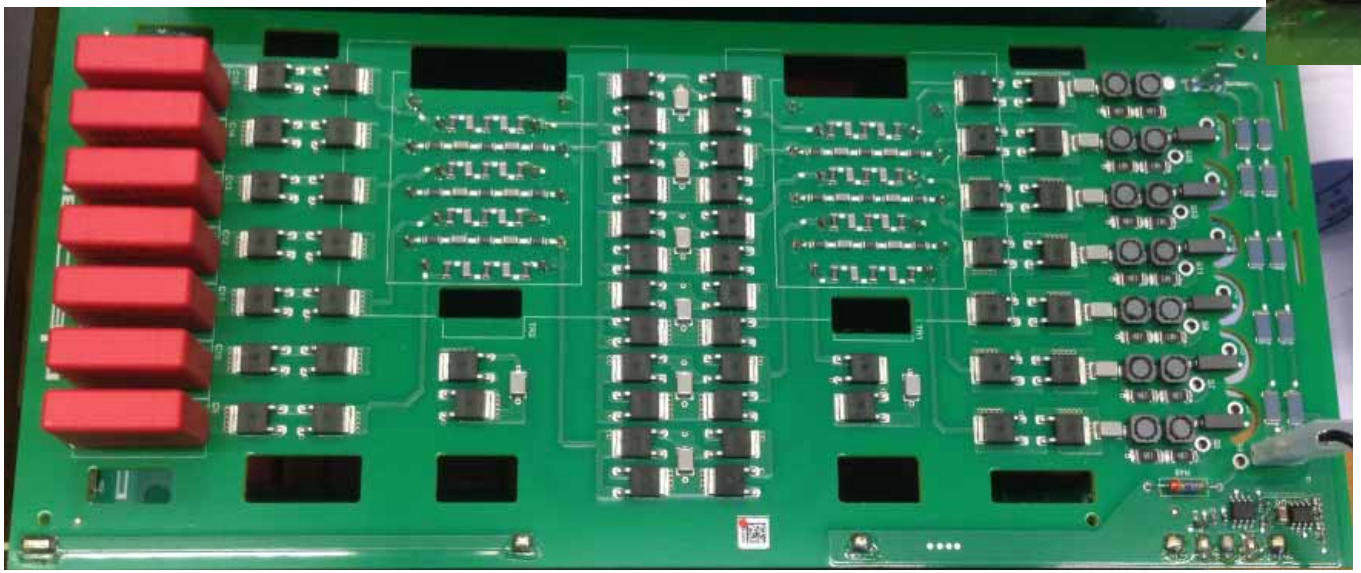
- Replace Bipolar with Unipolar Rectifiers
- Essentially No Switching Losses
- Higher Efficiency
- Reduction of Heat Sink Requirements
- Parallel Devices Without Thermal Runaway

Package

TO-252-2







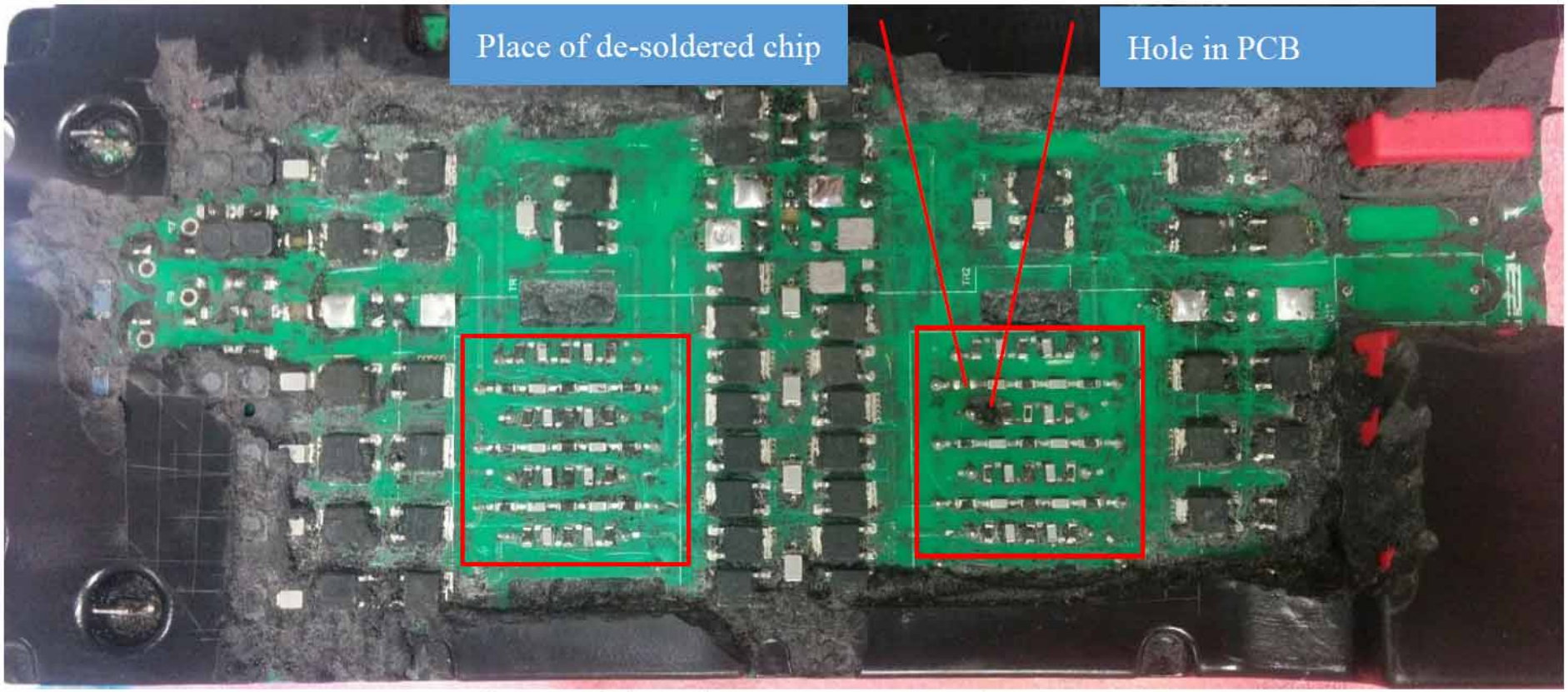
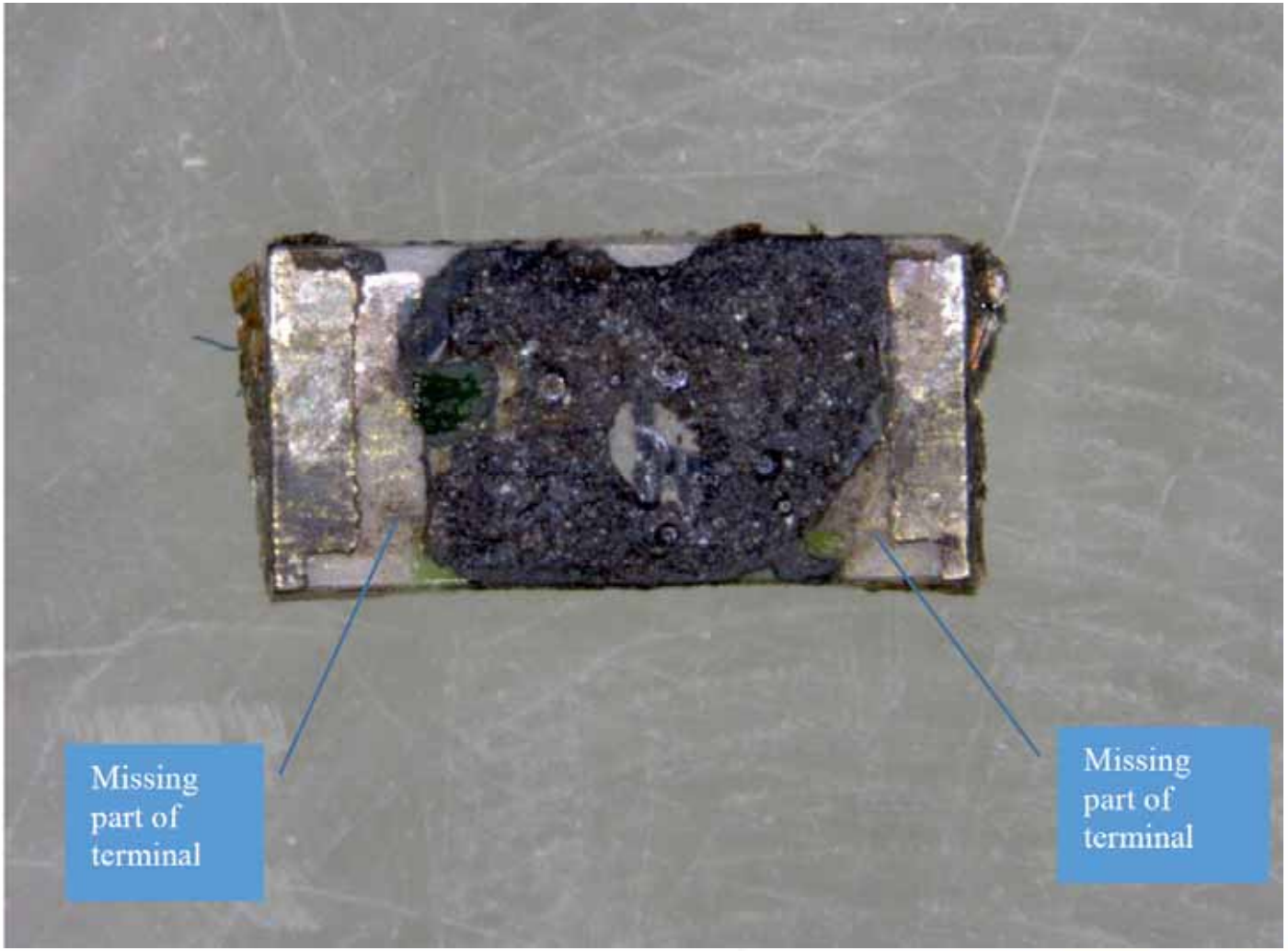
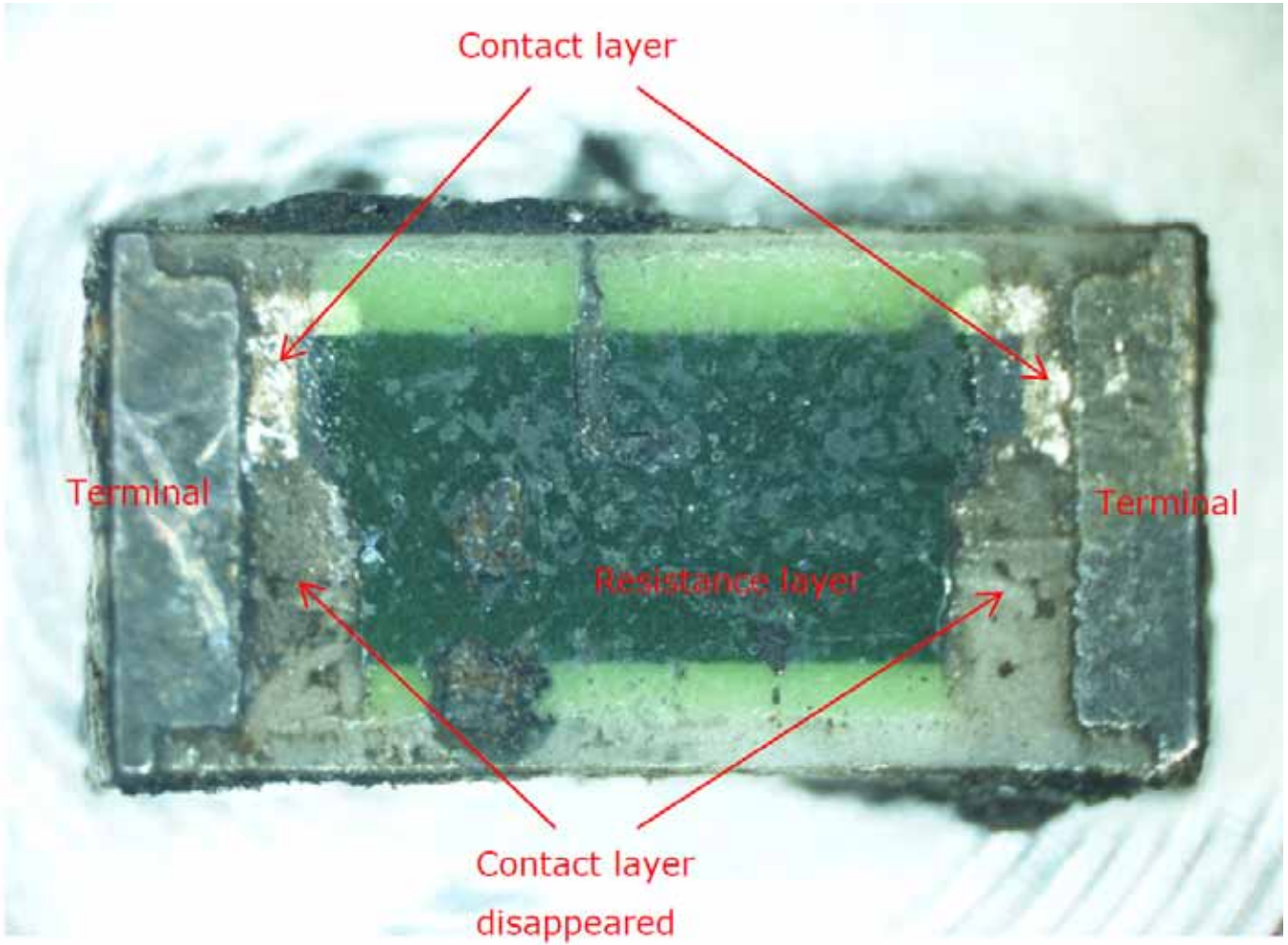


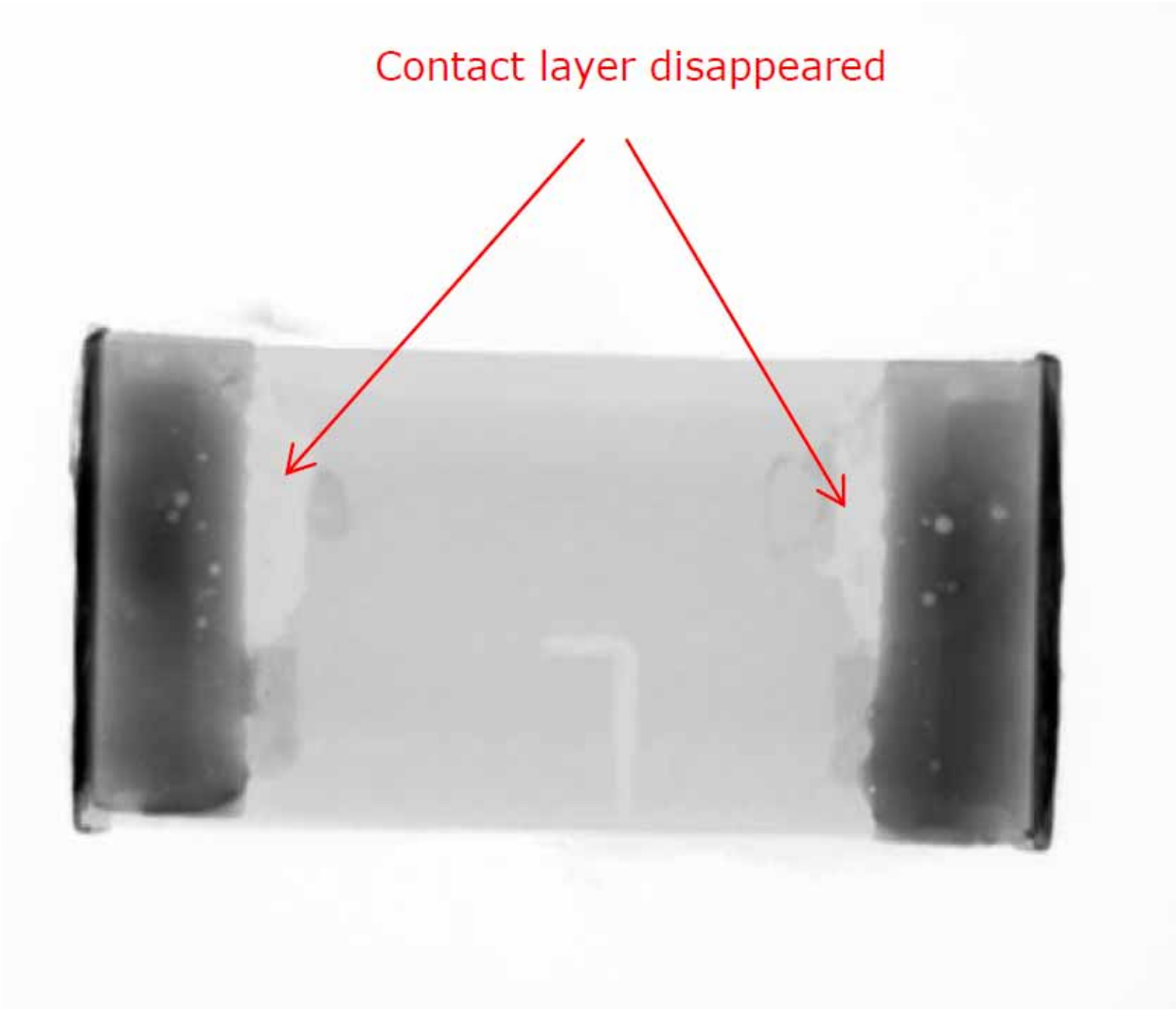
Fig.1. High voltage power supply PCB.


Missing part of terminal
Missing part of terminal

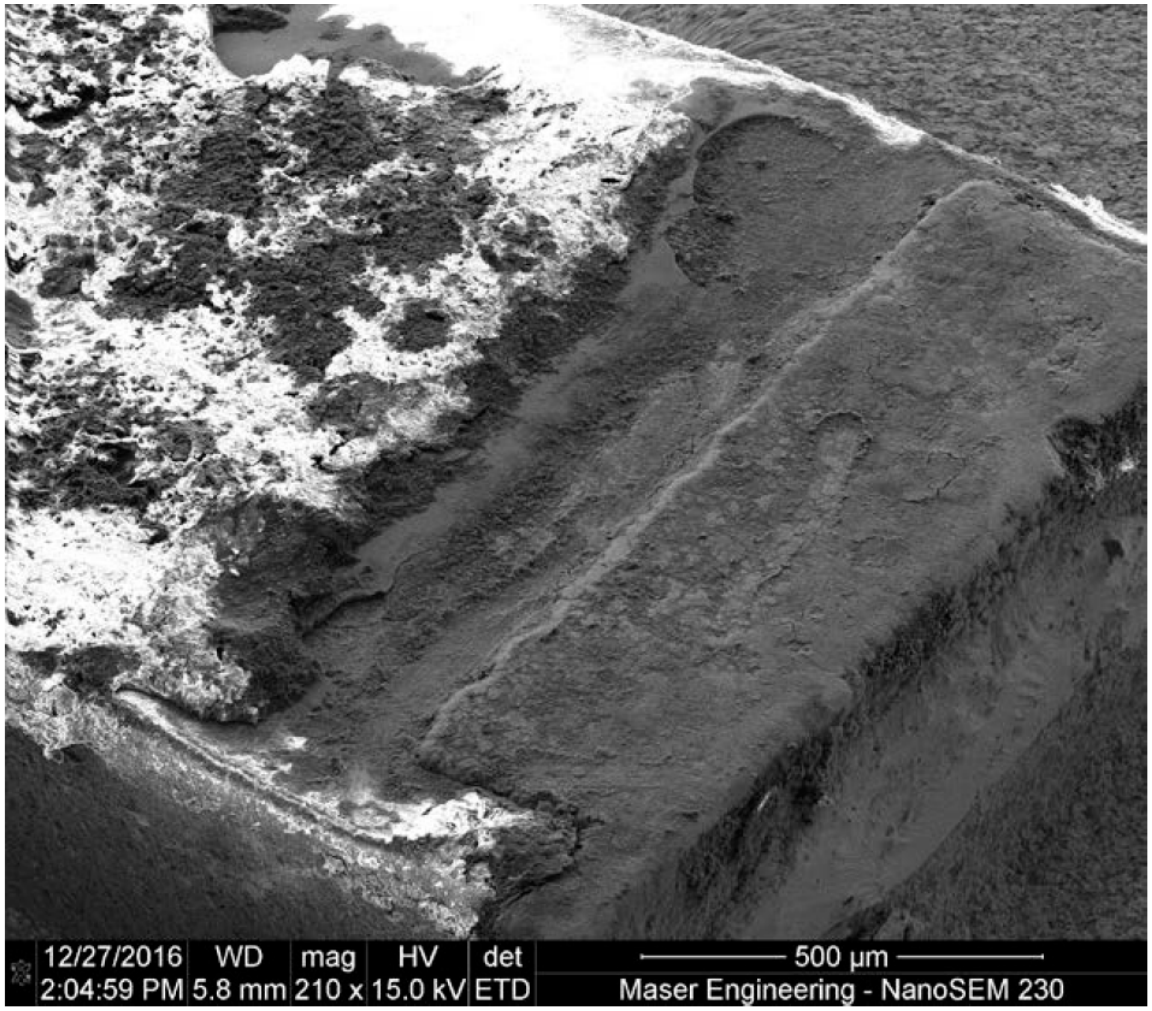
Maser


Contact layer
Terminal
Terminal
Resistance layer
Contact layer
disappeared

Maser

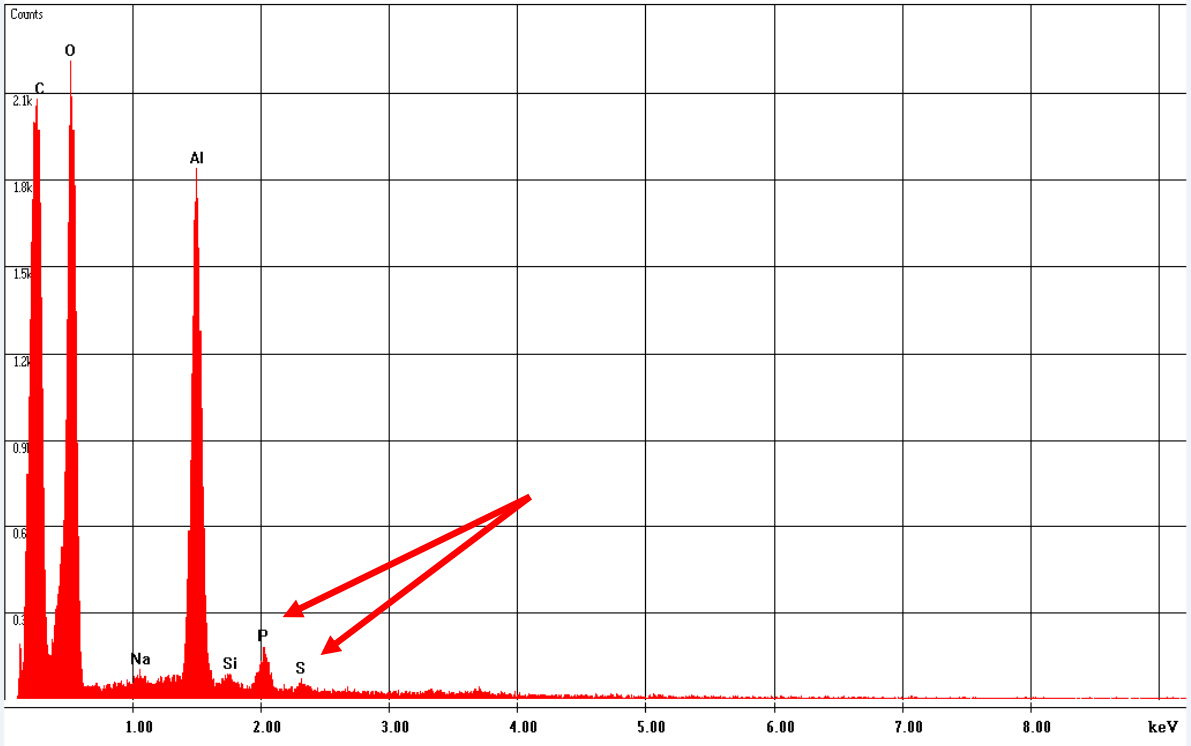


Maser


12/27/2016
2:04:59 PM
WD
5.8 mm
mag
210 x
HV
15.0 kV
det
ETD
500 µm
Maser Engineering - NanoSEM 230

c:\edax32\genesis\genspc.spc

Label A:



Dear Mr. Telgenhof,

please let me give you an explanation on the found peaks of chemical elements in the potting:

C and O are basic parts of the organic polymer matrix
Na and Si are part of the moisture adsorber
Al is part of the crystalline fire retardant
P is part of the liquid flame retardant
S is part of the anti-oxidation additive used in small amounts

All these chemicals are essential parts of the formulation and can't be deleted in the resin.

Hope this information is helpful to you.

In case of any questions, please feel free to contact us.

Mit freundlichen Grüßen / Best regards / 顺致敬意

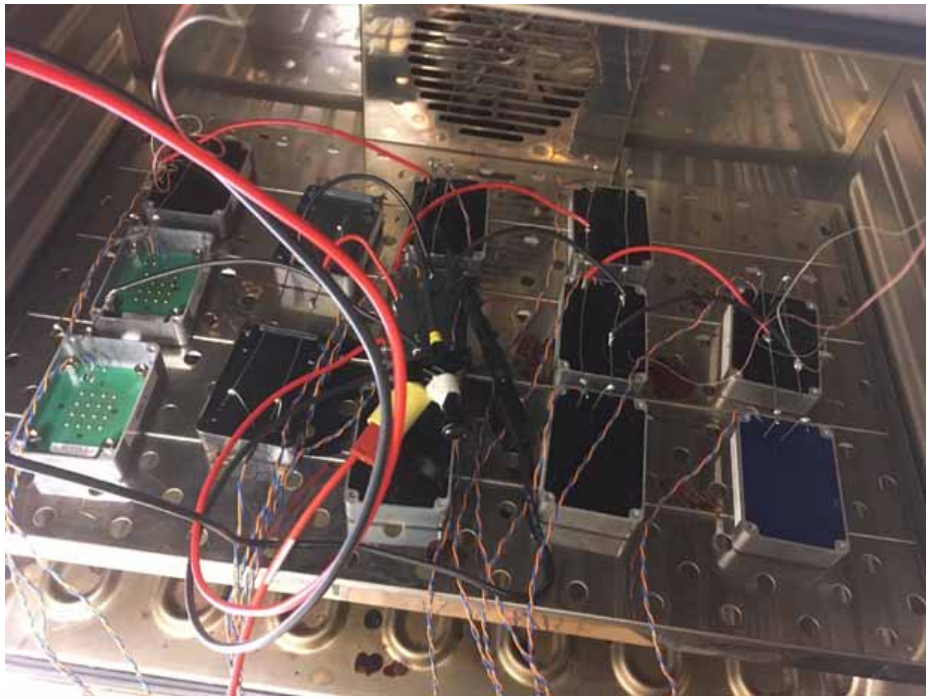
Temperature range of use: -60°C to +125°C .

The casting resin is used with **Hardener**.

Applications: Encapsulation and coating of pressure sensitive electrical and electronic components, e.g. sensors, SMD-equipped PCBs.

Product Specification:

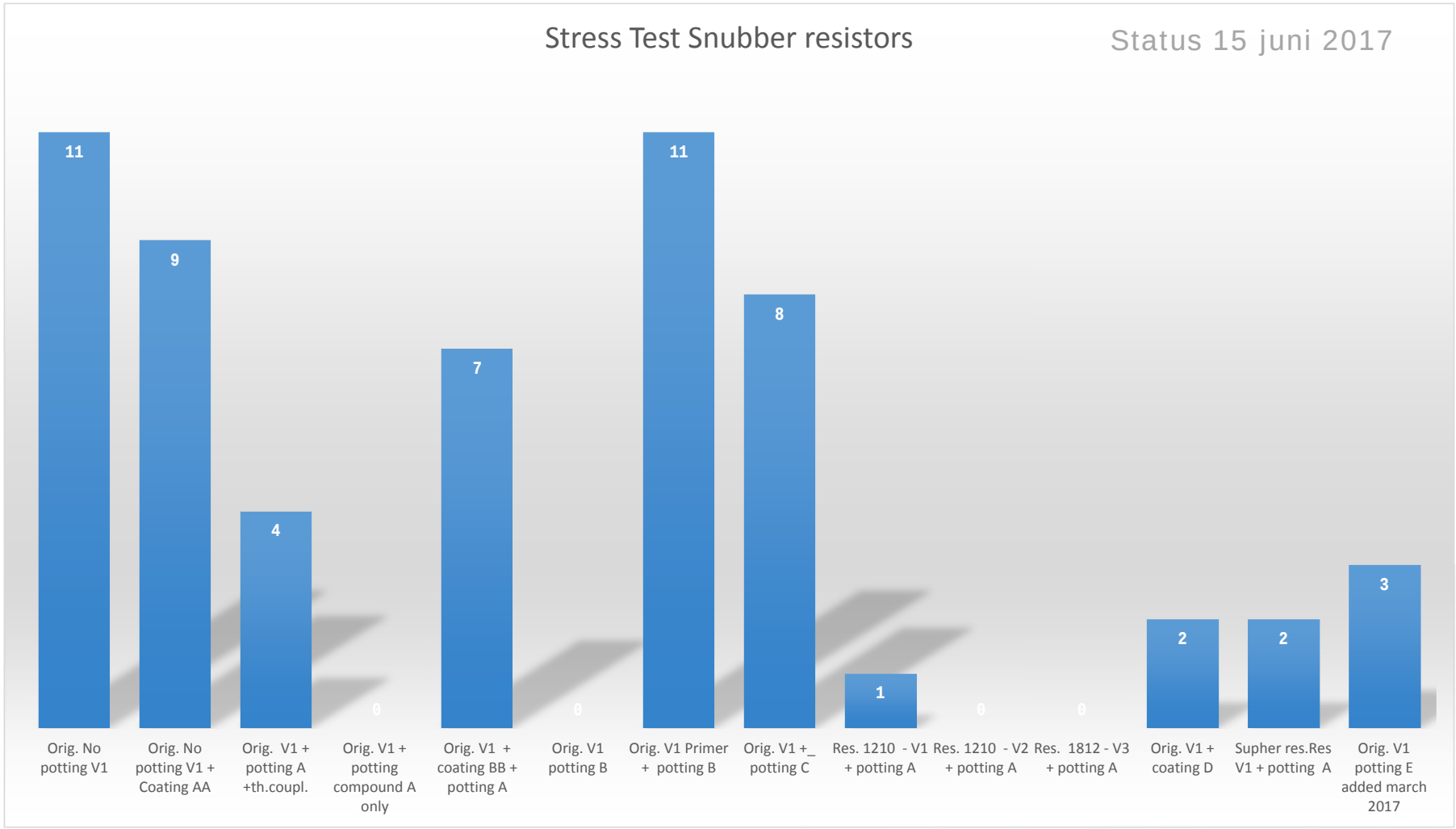
Onderzoek Snubber weerstand – ingiet materiaal



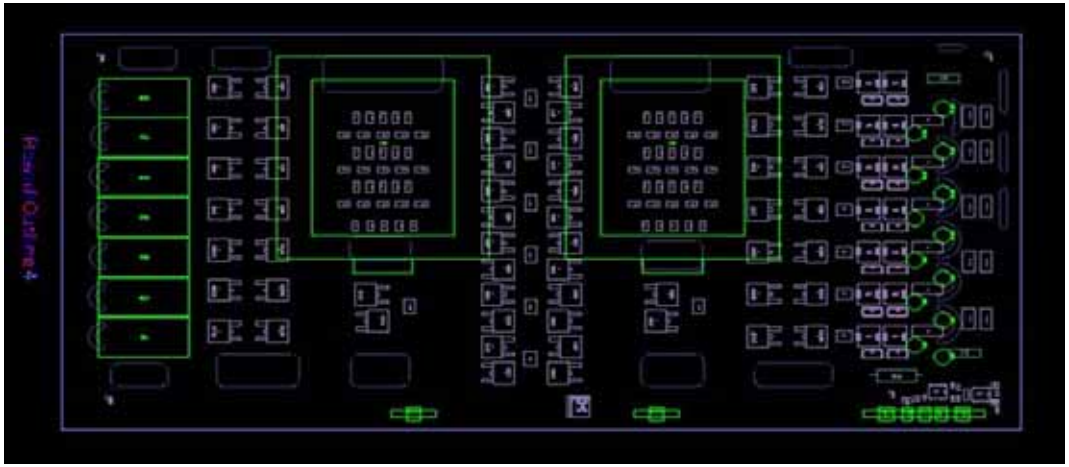
Surface mount resistors types 1206 / 1210 / 1812

1 Orig. No potting V1
2 Orig. No potting V1 + Coating xx
3 Orig. V1 + potting yy +th.coupl.
4 Orig. V1 + potting compound A only
5 Orig. V1 + coating zz + potting zz
6 Orig. V1 AA potting
7 Orig. V1 Primer + AA potting
8 Orig. V1 +_ potting BB
9 Res. 1210 - V1 + potting XX
10 Res. 1210 - V2 + potting XX
11 Res. 1812 - V3 + potting XX
12 Orig. V1 + coating CC
13 Supher res.Res V1 + potting XX
14 Orig. V1 potting DD added march 2017

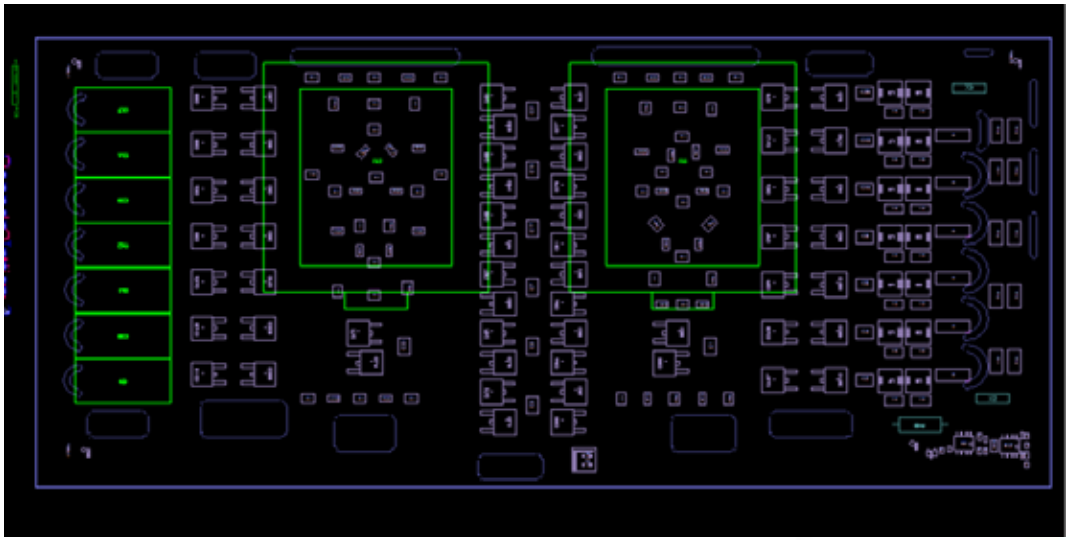
100% electrical load specified at 70°C, running at **125°C**

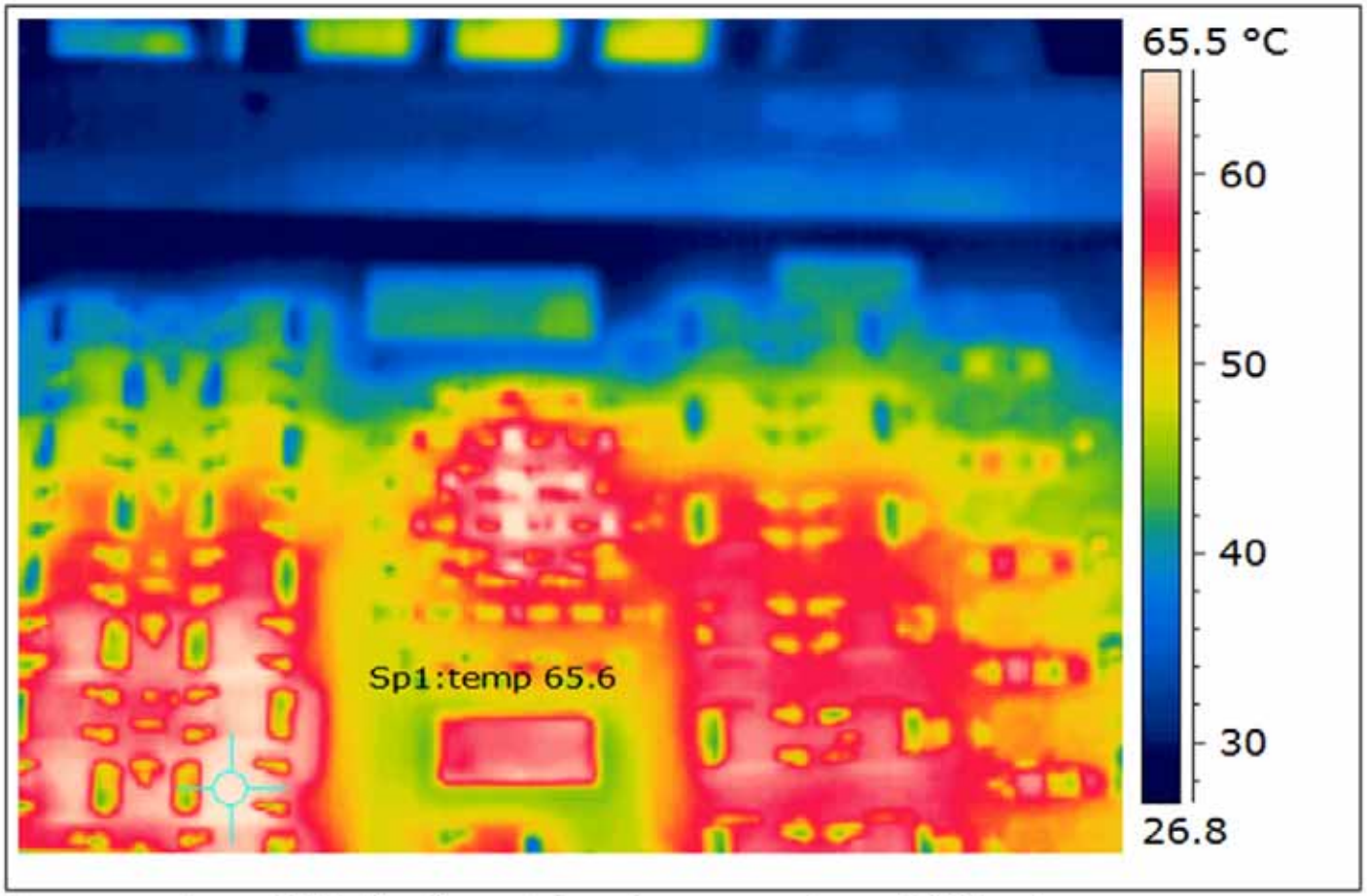

Stress Test Snubber resistors
Status 15 juni 2017
failed resistors
11
9
4
0
7
0
11
8
1
0
0
2
2
3
Orig. No potting V1
Orig. No potting V1 + Coating AA
Orig. V1 + potting A +th.coupl.
Orig. V1 + potting compound A only
Orig. V1 + coating BB + potting A
Orig. V1 potting B
Orig. V1 Primer + potting B
Orig. V1 +_ potting C
Res. 1210 - V1 + potting A
Res. 1210 - V2 + potting A
Res. 1812 - V3 + potting A
Orig. V1 + coating D
Supher res.Res V1 + potting A
Orig. V1 potting E added march 2017

old



new

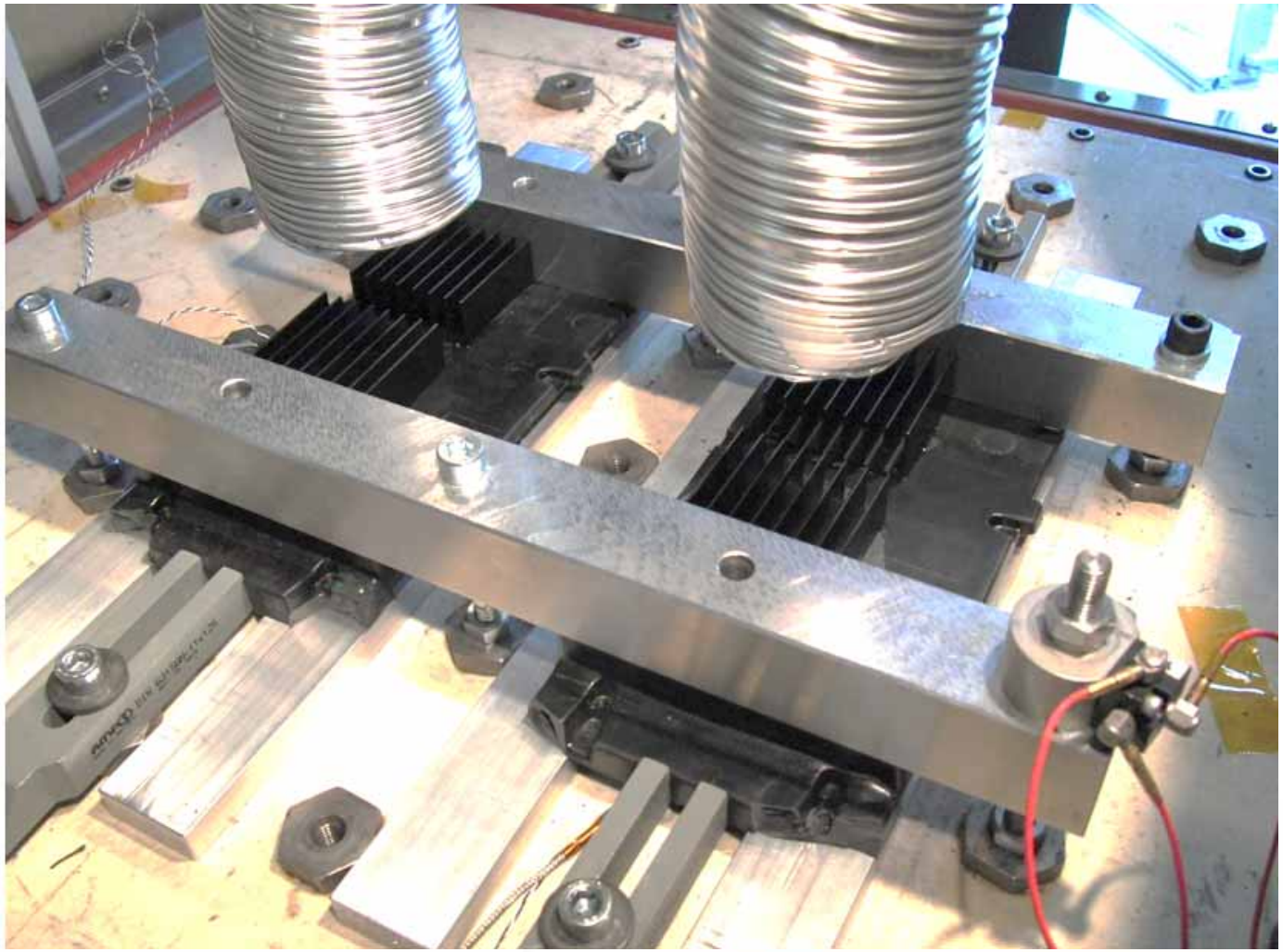




temperature HV diodes at load : 900mA.

Lagere temperatuur > toevoegen heatsink

HALT test



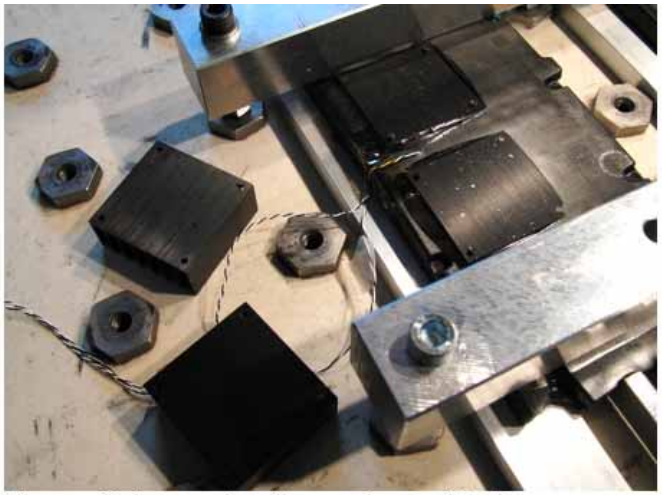


Figure 8. Losse koelbeugels na 40min

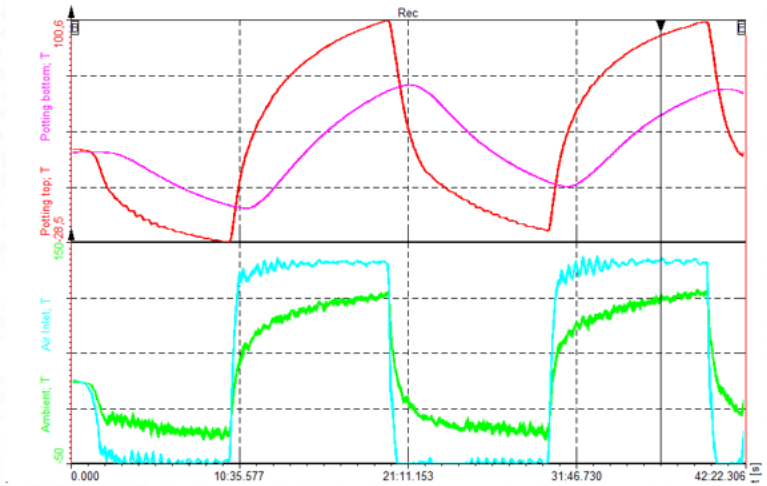


Figure 5. Eerste uitvalsmoment, 1 koelbeugel komt los

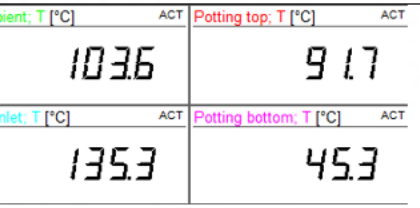


Figure 6. Actuele temperaturen uitvalsmoment

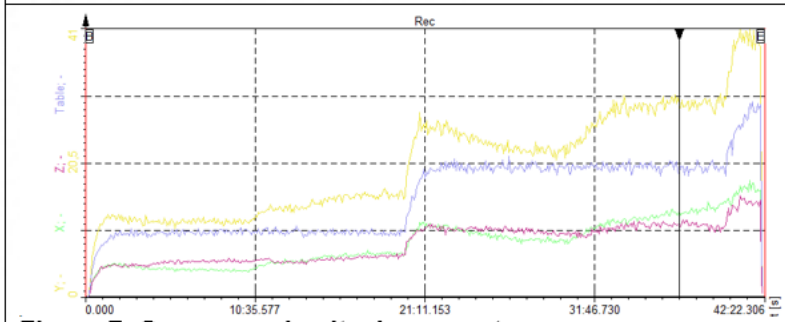
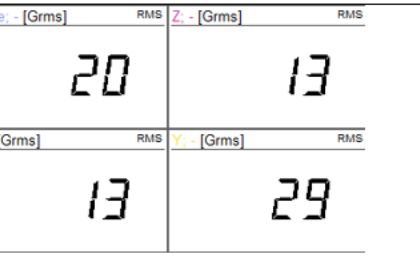


Figure 7. Grms waarde uitvalsmoment



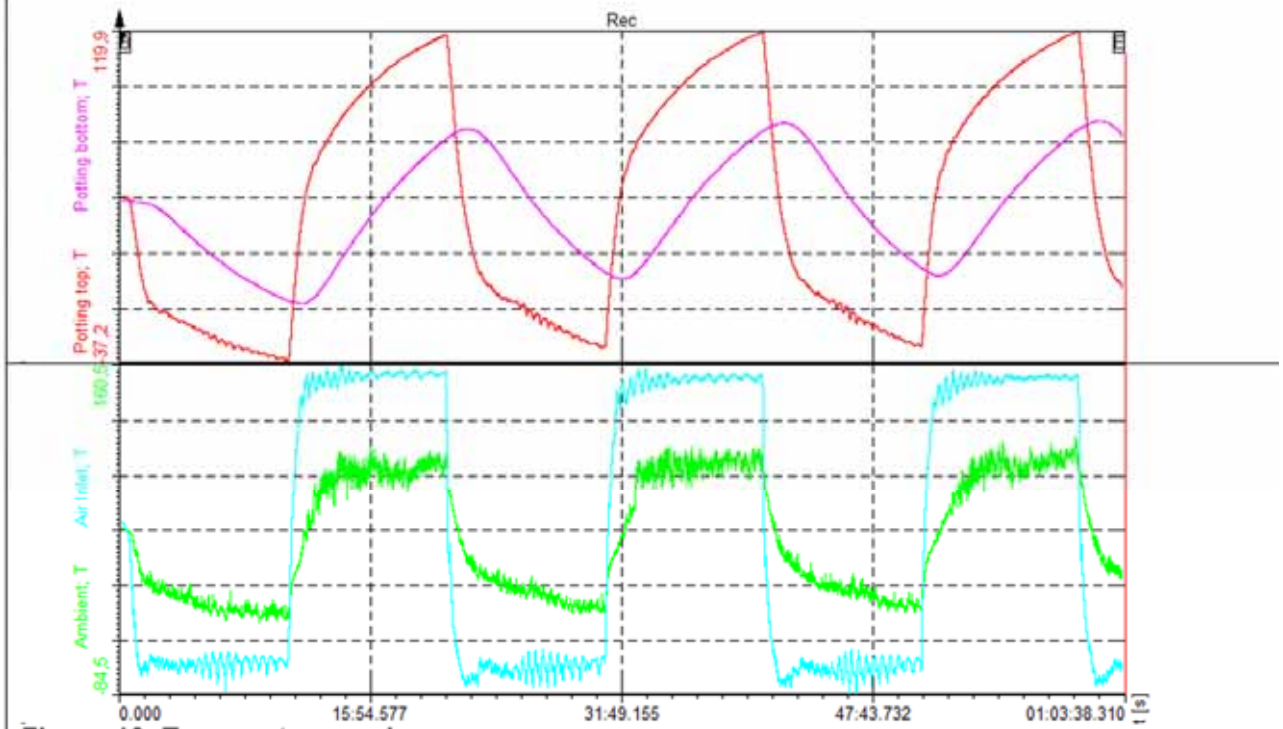
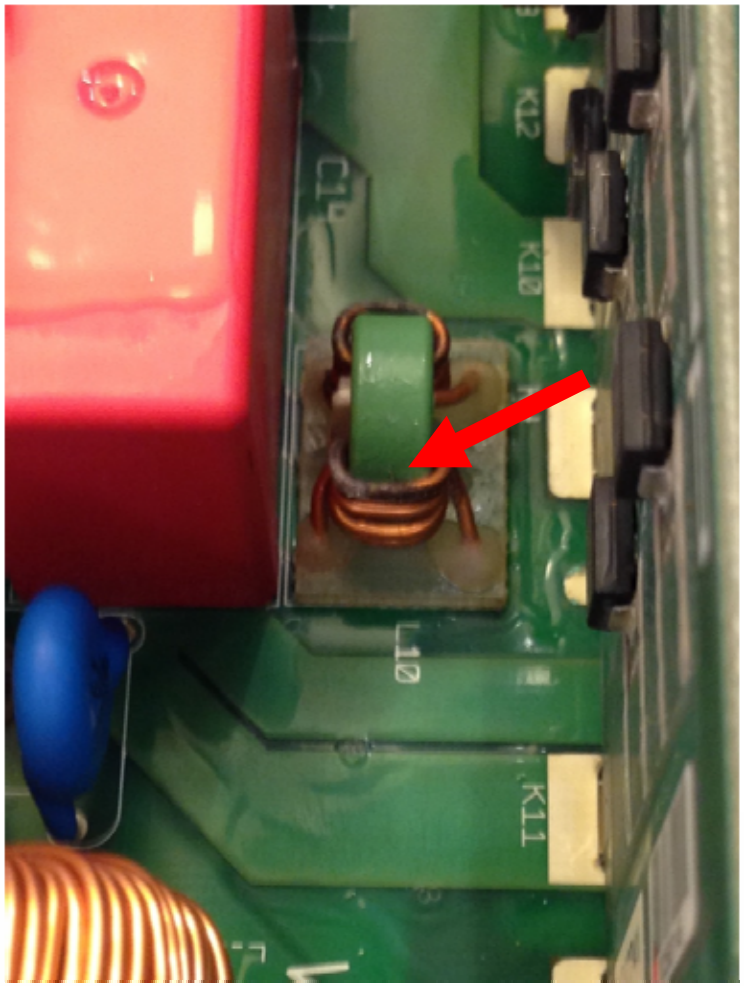
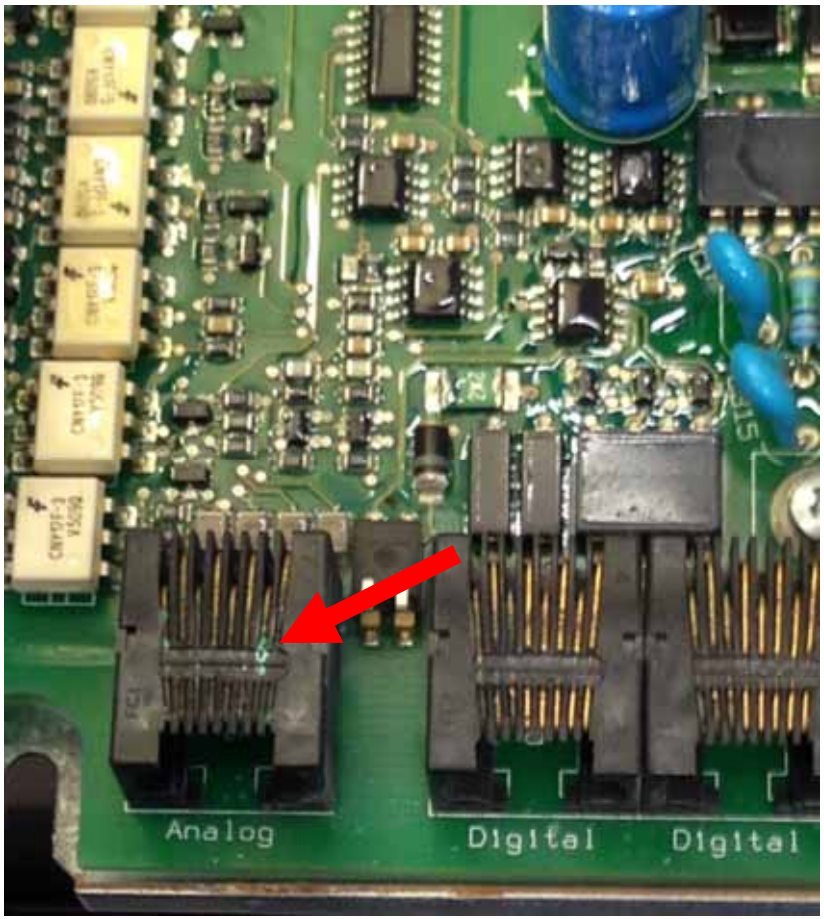


Figure 12. Temperatuur cycle
Rood = Potting top, Magenta = Potting bottom
Groen =Tambient, Blauw = T airinlet

Note: geen uitval
Conclusie: Na het lijmen van de koelbeugel met RTV162 kit laat deze niet meer los.
Limits -50°C +145°C
50Grms

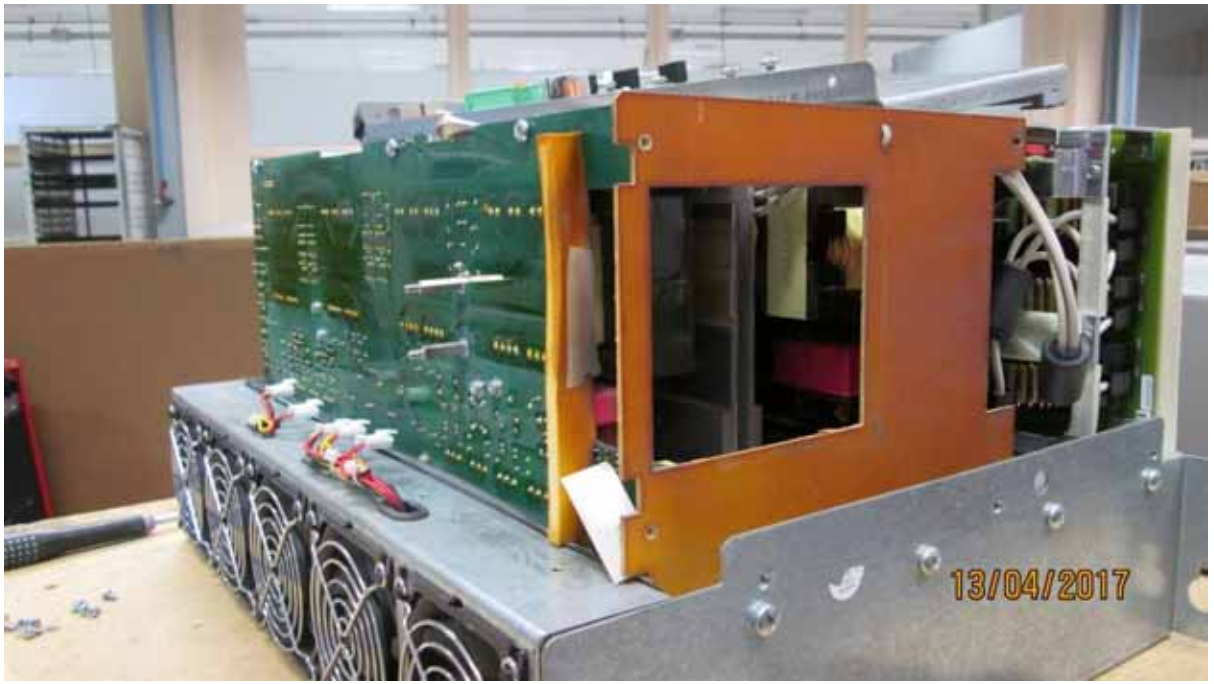
Temperatuur verlaging ± 15 °C


K12
K10
L10
K11


Analog
Digital
Digital

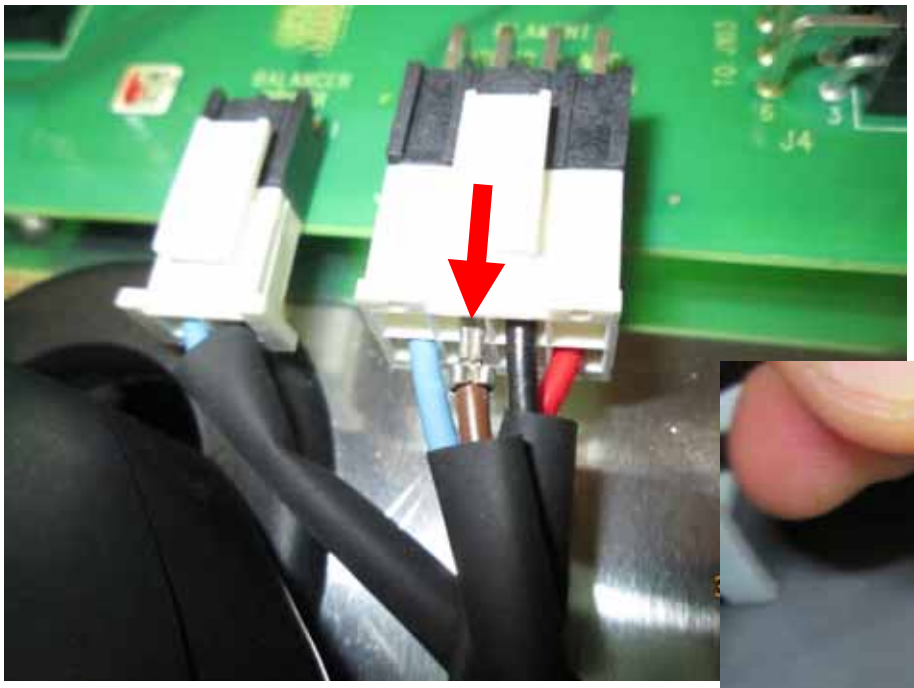

17/05/2017

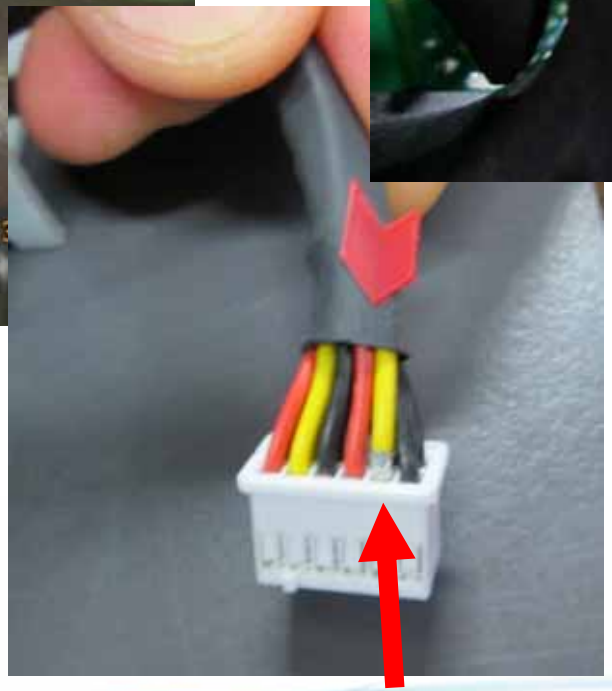
?

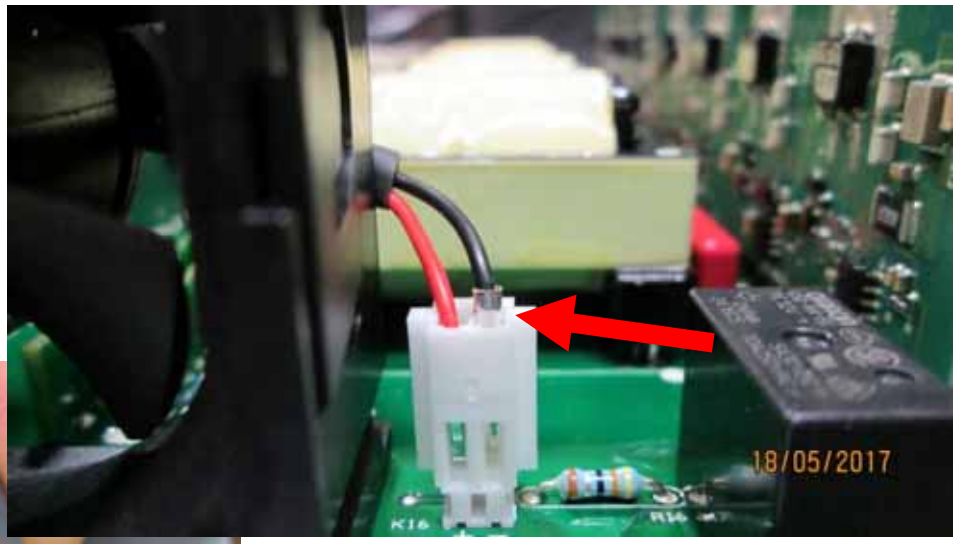


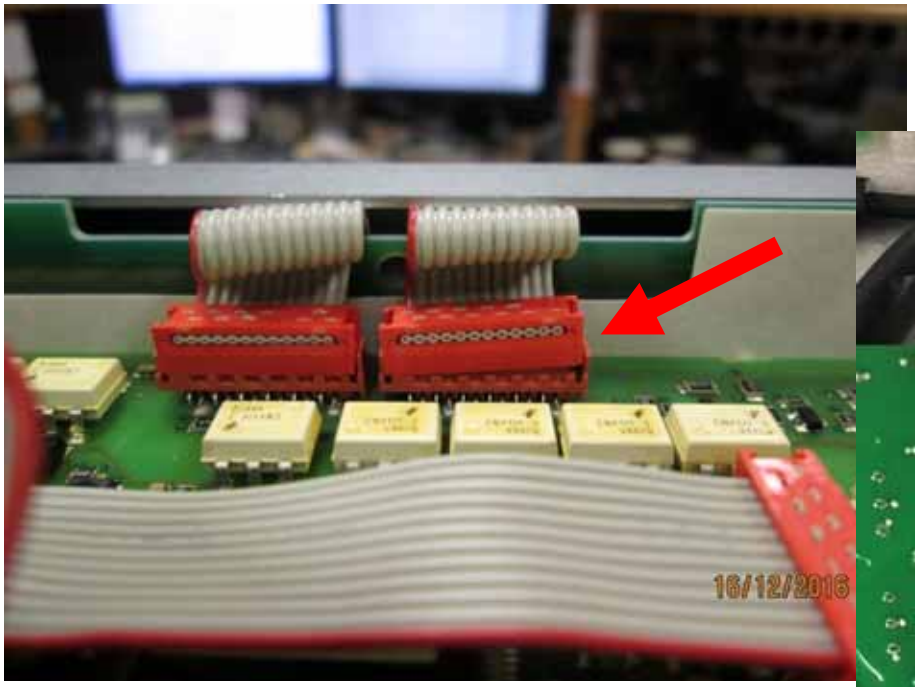
Constant hoge omgevingstemperatuur

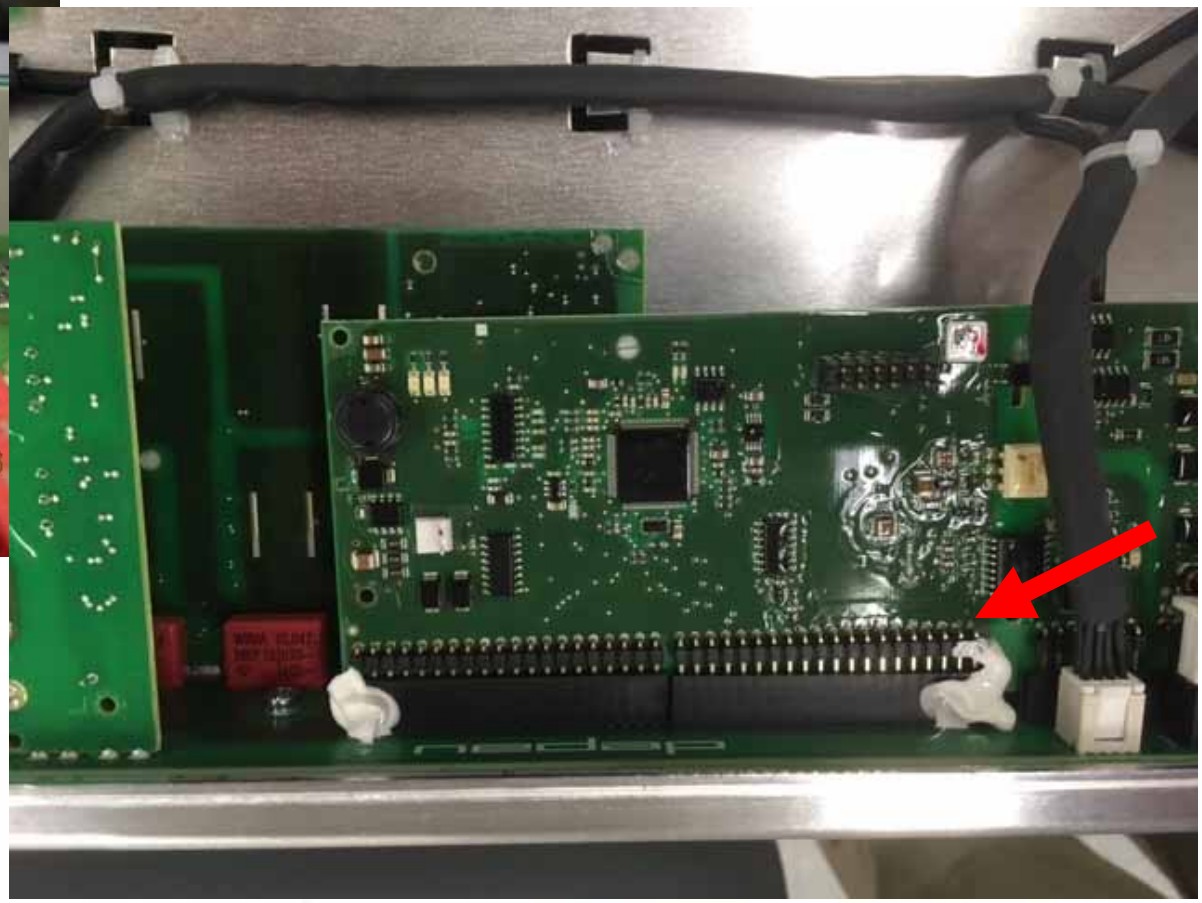
geen warme lucht afvoer

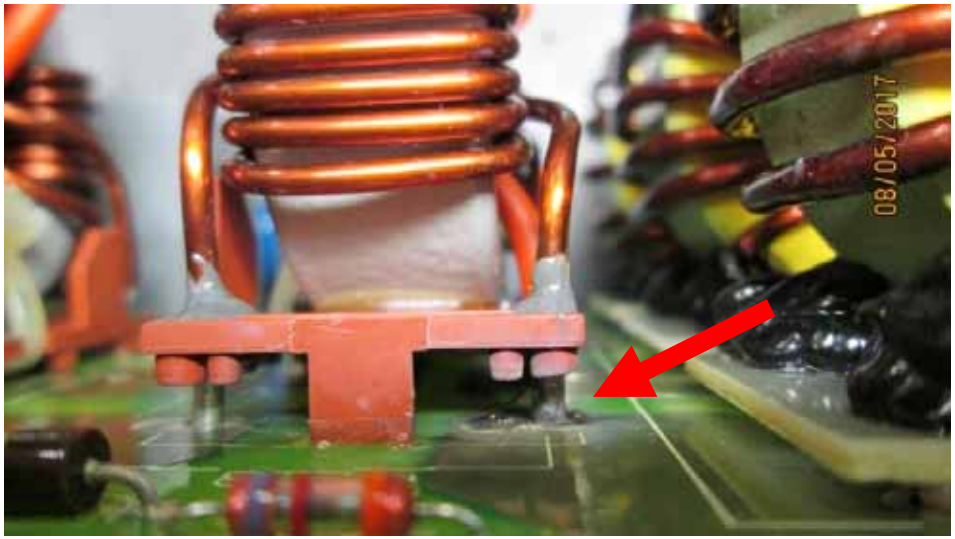

BALANCER
J4

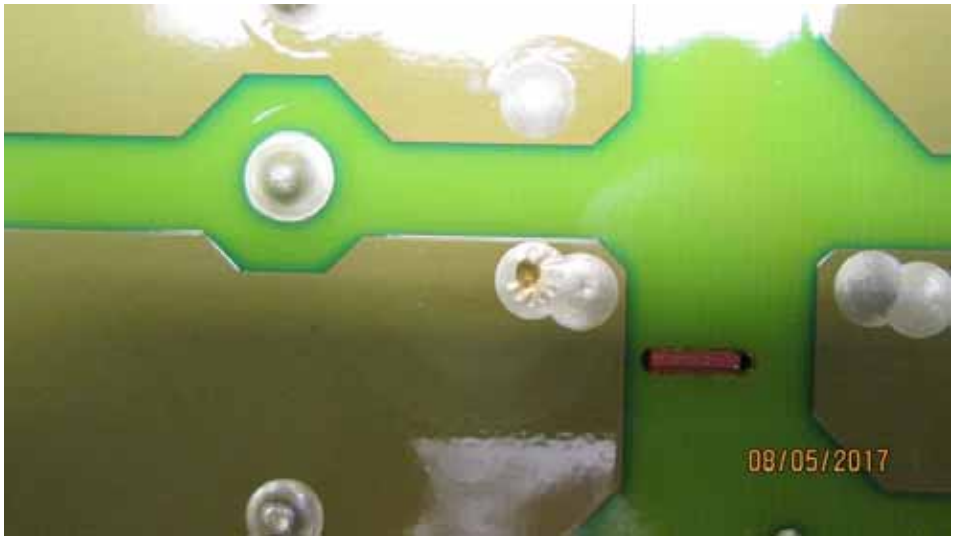



18/05/2017


16/12/2016







Slechte plaatsing component / soldering

Gebruik vlam dovend materiaal/componenten

nedap
technology that matters

Power electronics do's and don'ts...

PART 2

Tonnie Telgenhof Oude Koehorst
info@nedap-uv.com
www.nedap-uv.com

Power Components
Testing & EMC
Power Applications
Power Research

POWER ELECTRONICS 2017

20-06-17 - 1931 Congrescentrum Den Bosch