



Elektrische aandrijvingen in India

Wim Platschorre

8 juni 2016

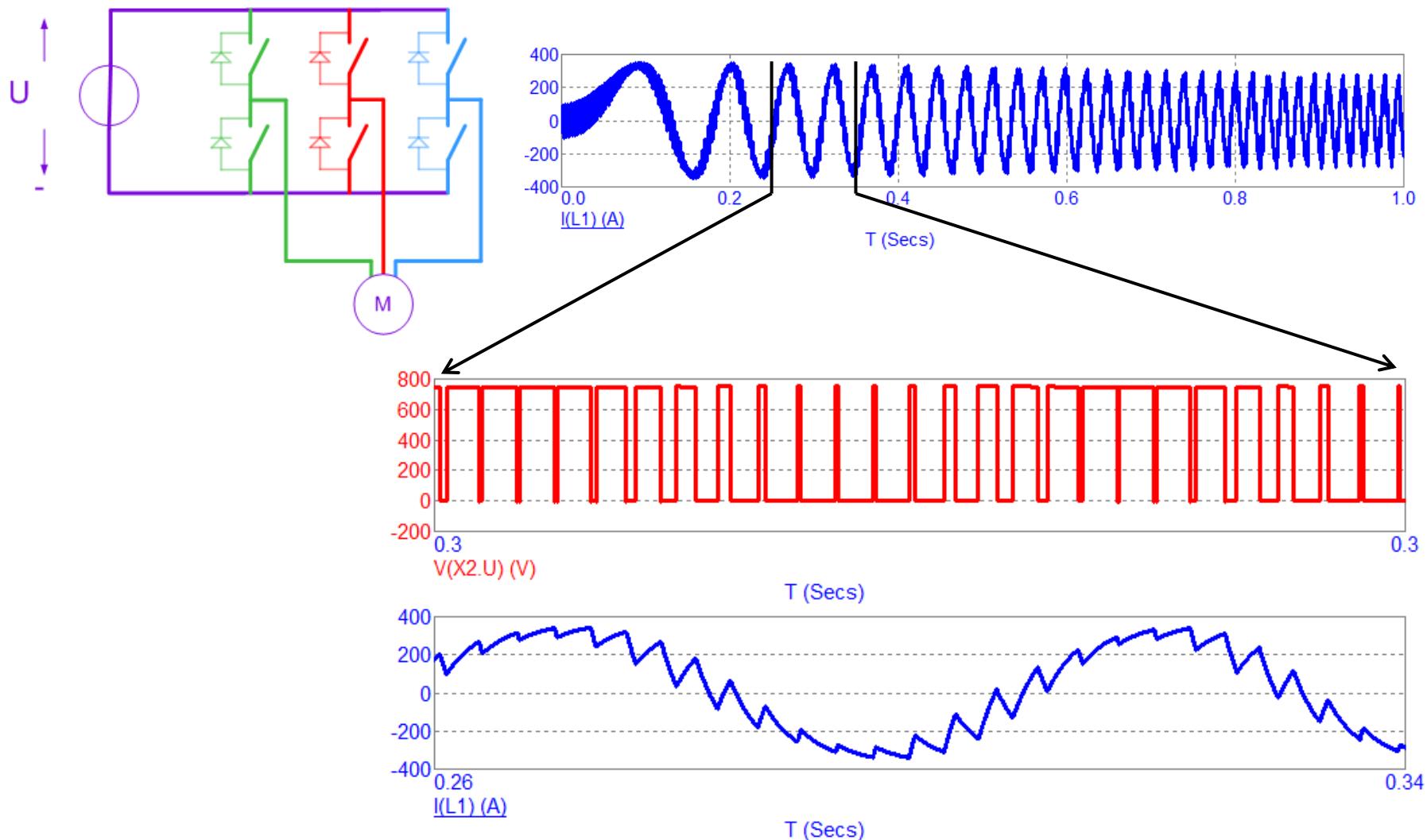
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DC-AC converter: inverter

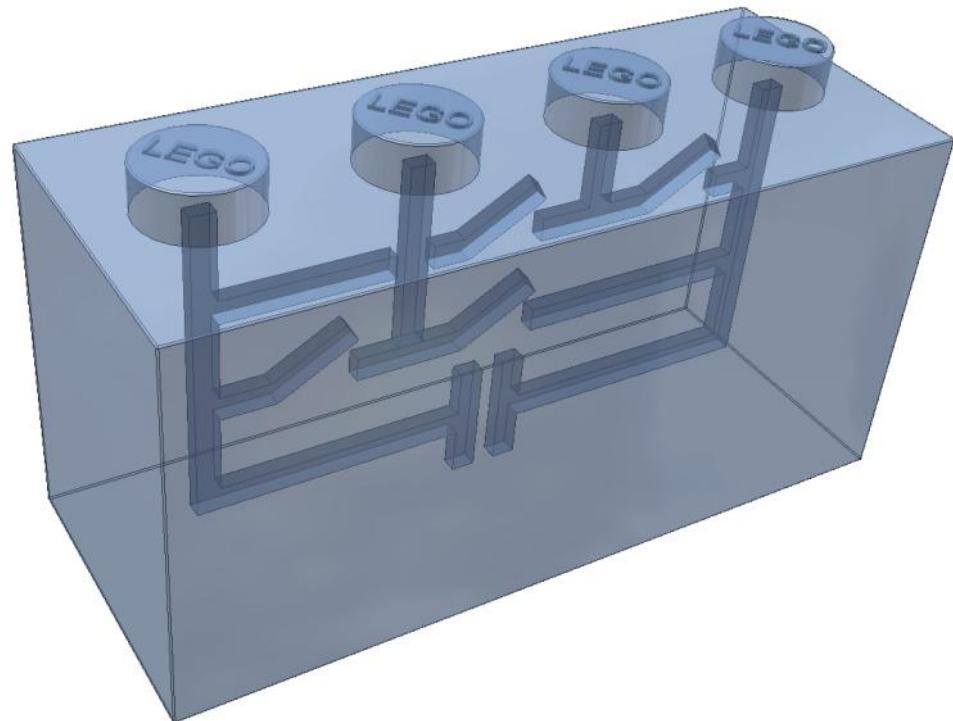




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Ideal power module

- All components on modules
- Module functionality independent
- Protection and diagnosis onboard every module

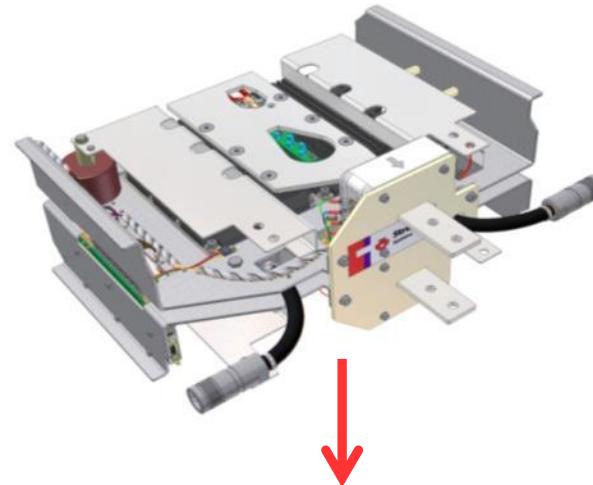




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Watergekoelde aandrijving

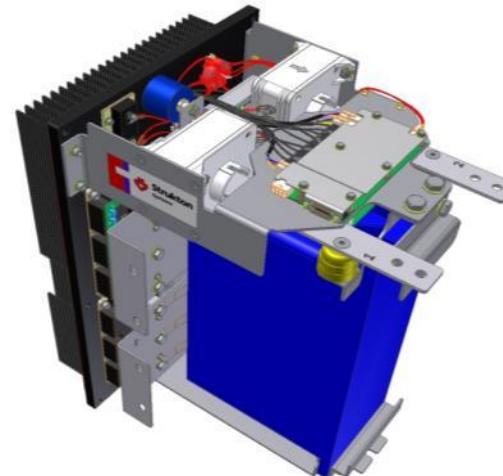




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Luchtgekoelde aandrijving





Omstandigheden in India

- Hoge omgevingstemperatuur
- Hoge luchtvochtigheid
- Veel stof
- Gevaar voor corrosie
- Slechte railcondities: veel schokken en trillingen
- Ruwe behandeling tijdens onderhoud



IEC61287 Subclause	Test Description	Location	Remarks	OK/NOK
4.5.3.1	Visual inspection	WS	Routine Test	OK
4.5.3.2	Verification of dimensions and tolerances	WS	Type test	OK
4.5.3.3	Weighing	WS	Type test	OK
4.5.3.4	Marking inspection	WS	Routine Test	OK
4.5.3.5	Cooling test	WS	Type test	OK
4.5.3.5.3	Check of effectiveness of filters	N/A	Not Applicable	n.a.
4.5.3.5.4	Leakage test	WS	Routine Test	OK
4.5.3.6	Test of mechanical and electrical protection and measurement equipment	WS	Type Test	OK
4.5.3.7	Light load test	WS	Routine Test	OK
4.5.3.8	Test of the degree of protection	N/A	Not Applicable	n.a.
4.5.3.9	Commutation test	WS	Type test	OK
4.5.3.10	Acoustic noise measurement	N/A	Not Applicable	n.a.
4.5.3.11	Temperature rise	WS	Type test	OK
4.5.3.12	Power loss determination	N/A	Not Applicable	n.a.
4.5.3.13	Supply overvoltage and transient energy	N/A	Not Applicable	n.a.
4.5.3.14	Sudden variations of load tests	WS	Type test	OK
4.5.3.15	Insulation resistance test	WS	Routine Test	OK
4.5.3.16	Dielectric test	WS	Routine Test	OK
4.5.3.17	Partial discharge	N/A	Not Applicable	n.a.
4.5.3.18	Safety requirements	WS	Routine Test	OK
4.5.3.19	Vibration and shocks	TNO Delft	Type test	pending
4.5.3.20	Electromagnetic compatibility	WS	Type test	OK
4.5.3.21	Step change of line voltage test	N/A	Not Applicable	n.a.
4.5.3.22	Short time supply interruption test	N/A	Not Applicable	n.a.
4.5.3.23	Current sharing test	WS	Type test	OK



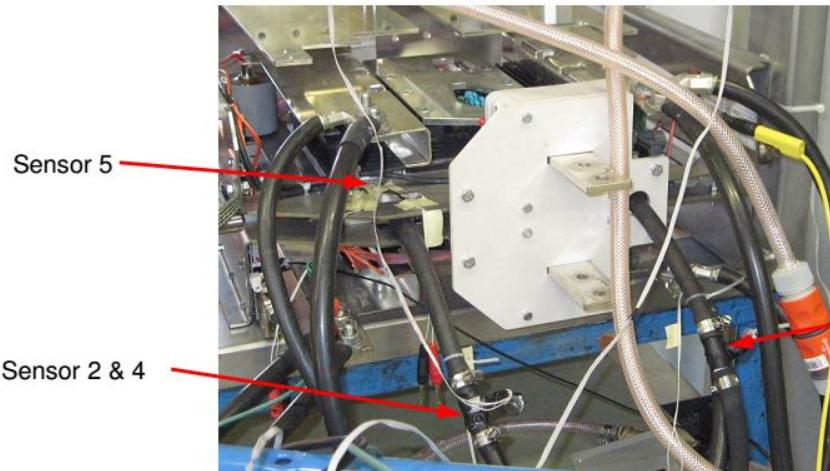
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Leakage test

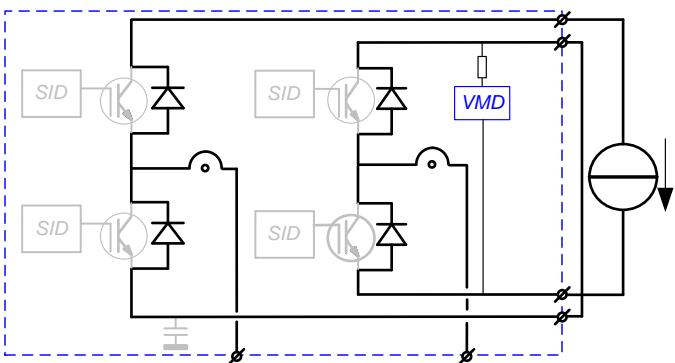


Cooling test



Sensor 2 & 4

— Sensor 1 & 3



Cooling performance test set-up





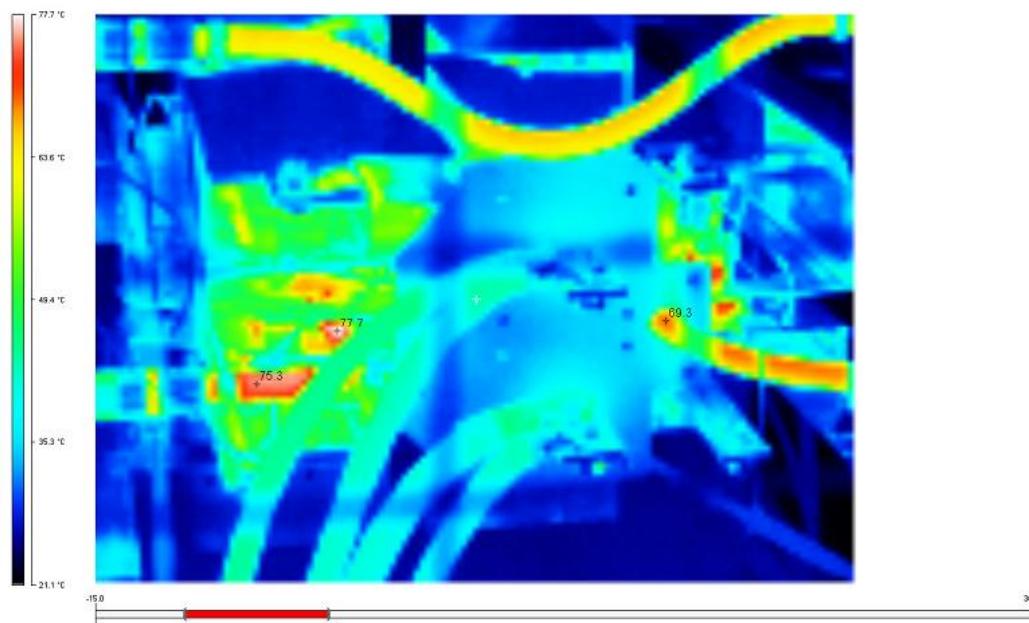
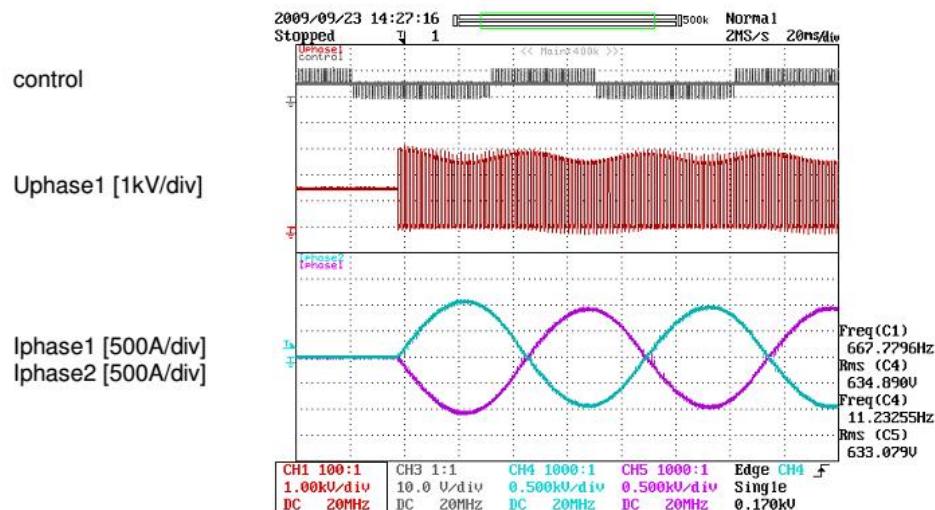
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Temperature rise test



thermal image at 700A, 457 Hz.
All parts are below 80°C



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Commutation test

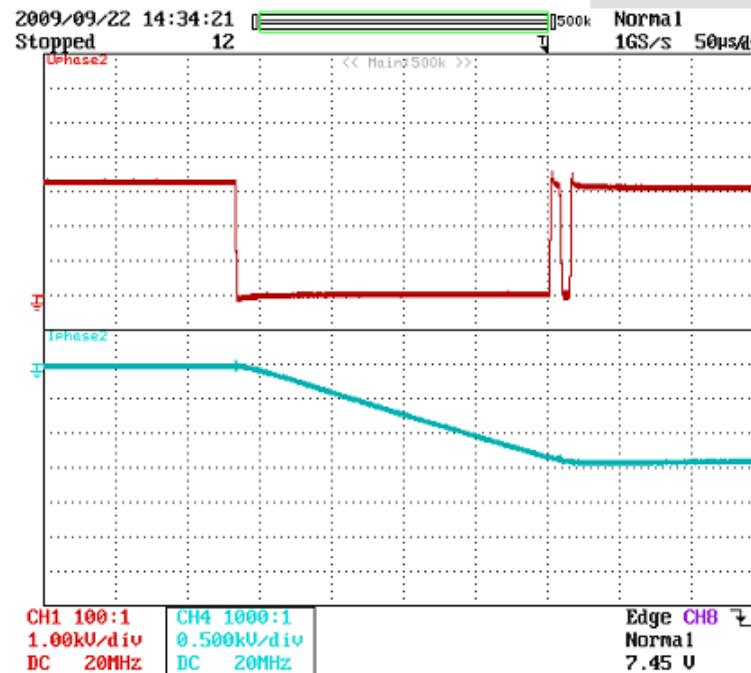
Test
Commutation test on
BOT2 IGBT (Bottom
IGBT of Phase 2)

Requirement
L connected between Phase 2 and
Positive

Acceptance Criteria
Proper commutation at
 $I < 1500A \pm 50A$: no I_{max} error

result
OK

Uphase2 [1kV/div]



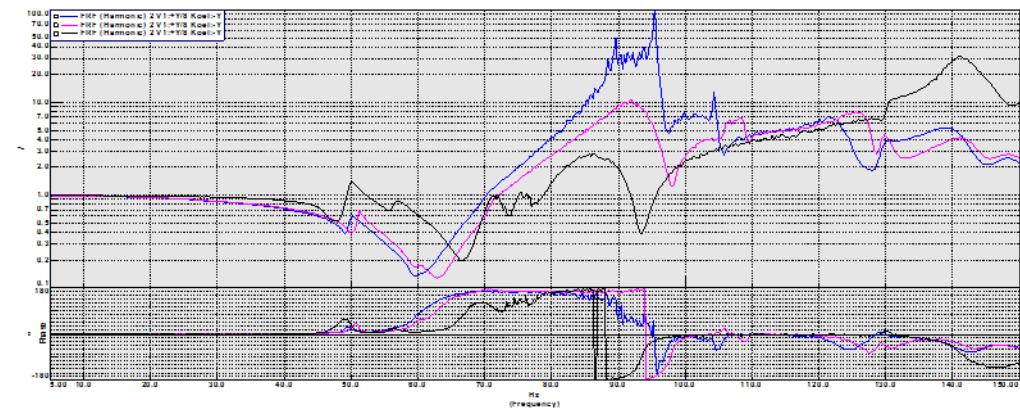
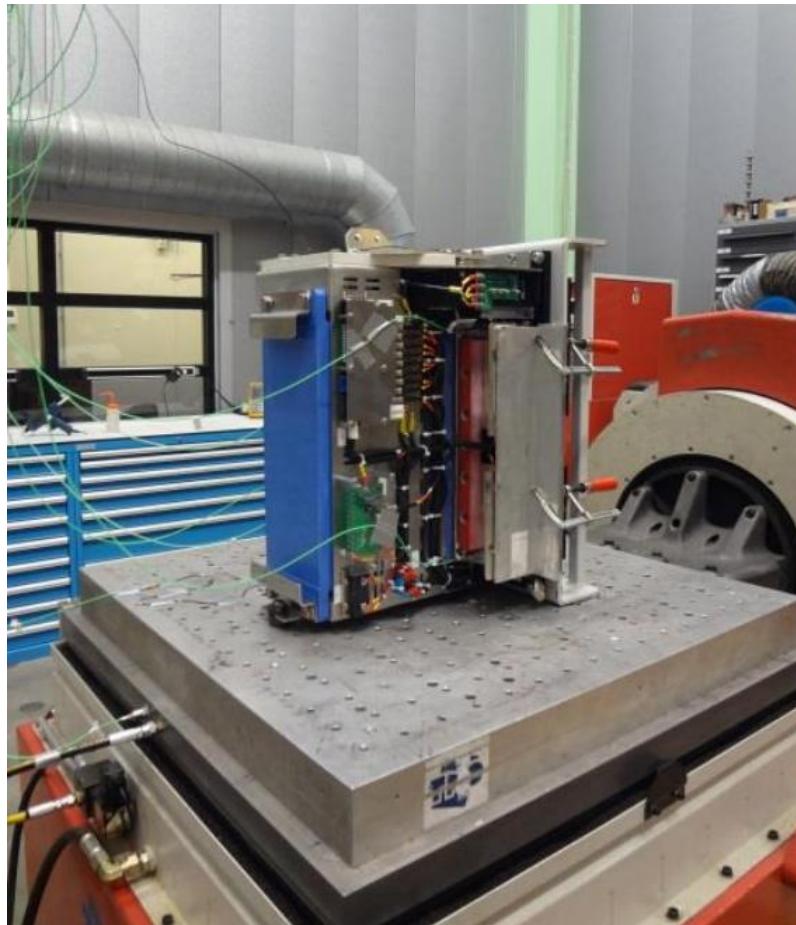
Iphase2 [500A/div]



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Vibration and shock test





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Degree of protection test



Waterdichtheid



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Degree of protection test



Stofdichtheid



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Trieste resultaten in India





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Metingen op het dak





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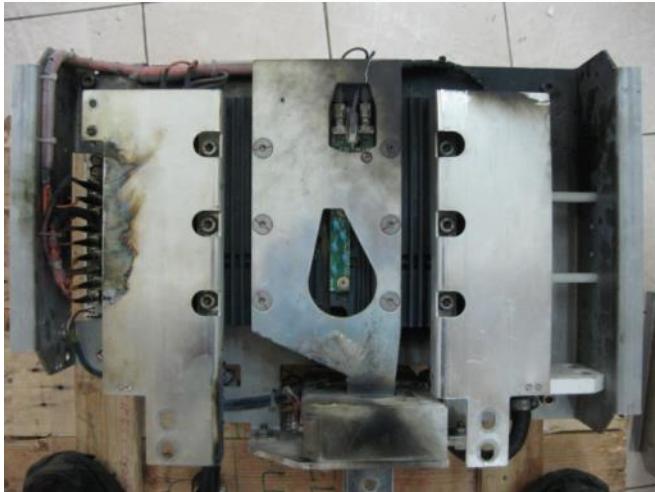
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Metingen in de locomotief





Dubbele fout



Losse connector

Losse connector, geen voedingsbeveiliging op de driver + falende kortsluitbeveiliging => 4 modules defect

Conclusie: extra beveiling toevoegen om taksluiting te voorkomen



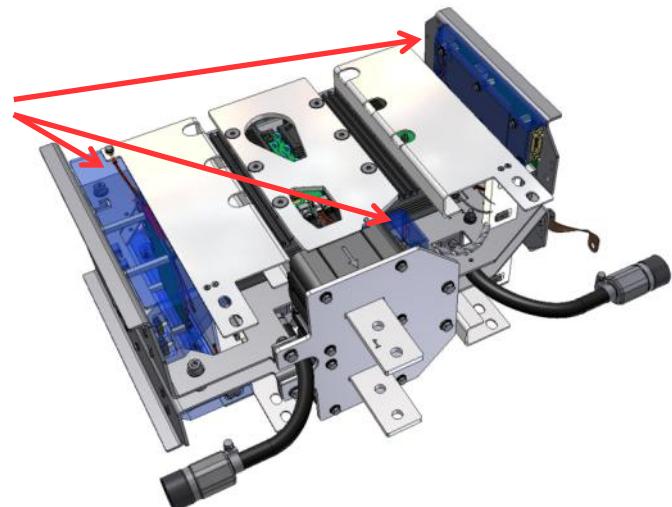


- Vocht: kasten staan lang opgeslagen in vochtig klimaat
- Verkeerde behandeling: modules worden aan elektrische strippen opgetild
- Slechte verbindingen

Lessen:

Betere afscherming van kwetsbare onderdelen

Gevolgschade beperken





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Vragen?

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