

CONFIDENTIAL



ECN reference design bifacial module

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Design Considerations for Bifacial PV in MGS

Laminate and system considerations for MGS (Modulair Geluids Scherm)

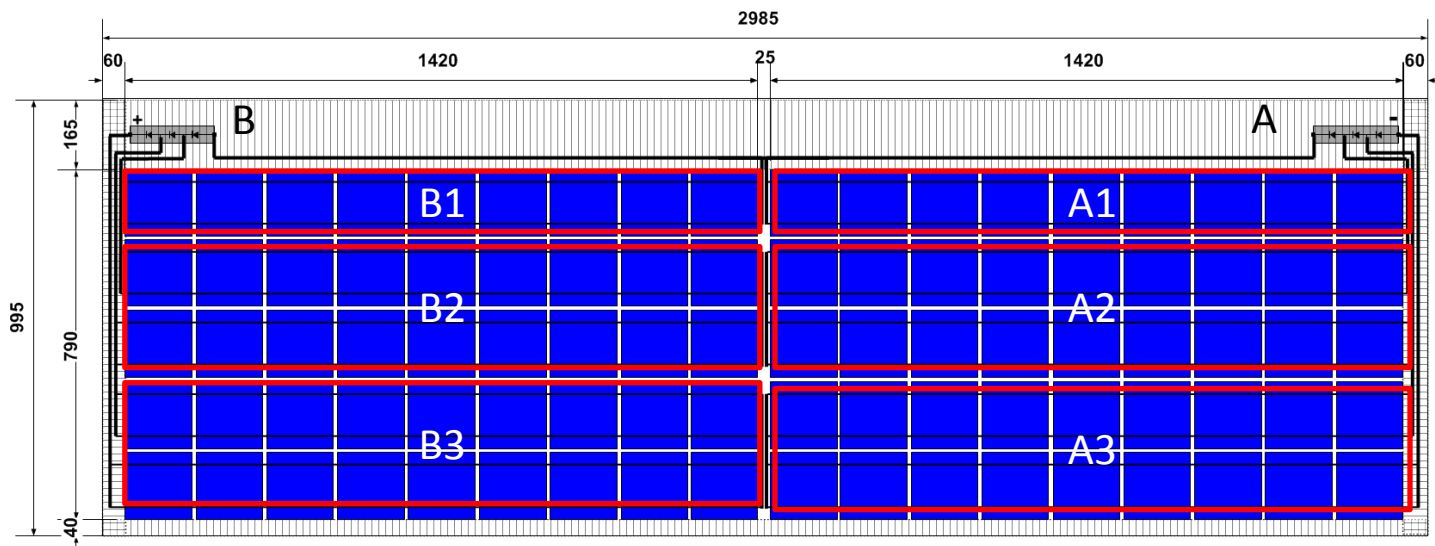
- All panels or elements in the barrier should be the same from barrier builder point of view
- Barrier may have lower and higher parts with different tilt angle
- Modularity should be maintained on both panel and system level
- Severe self-shading by panel frame and construction poles
- Bifacial PV technologies set higher requirements for all electrical components
- Application of additional layers of PVB may set additional requirements for laminate edges
- Legislation and norms for noise barriers *and* electrical installations *and* IEC for PV must be met
- Applicable electrical and other safety requirements must be met in case of road accidents or vandalism



ROK 1.2 Richtlijn Ontwerp Kunstwerken	GCW 2012 Richtlijnen geluidbeperkende constructies langs wegen	prNEN-EN 14388:2014 Verkeersgeluidbeperkende constructies
NEN-EN 1794-1 ...Mechanical performance & stability requirements	NEN-EN 1794-2 General safety and environmental requirements	RTD 1014 General requirements on electrotechnical installations V3.0

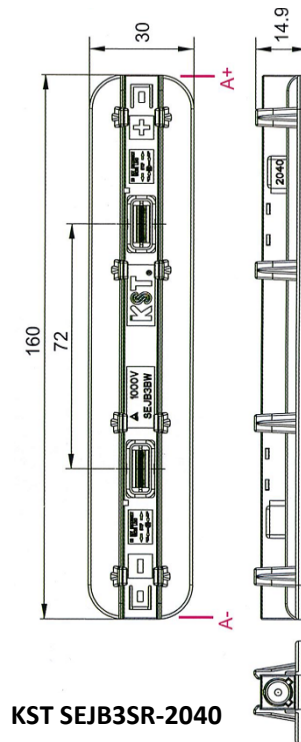
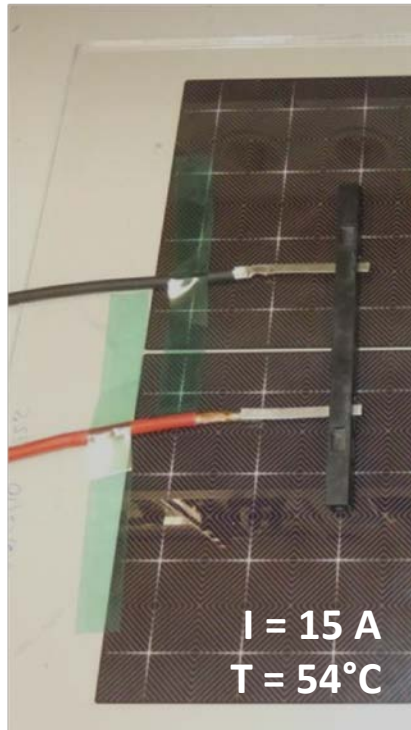


Predesign MGS-PV: Laminates



- Predesign for laminate: maximum number of cells
- Design measures for horizontal and vertical self shading
- Compliance with all considerations
- Discussed with manufacturer: manufacturable, cell spacing critical for production
- Decided to modify design: 90 cells → 85 cells

Critical Aspects: Bypass Diodes & Junction Boxes



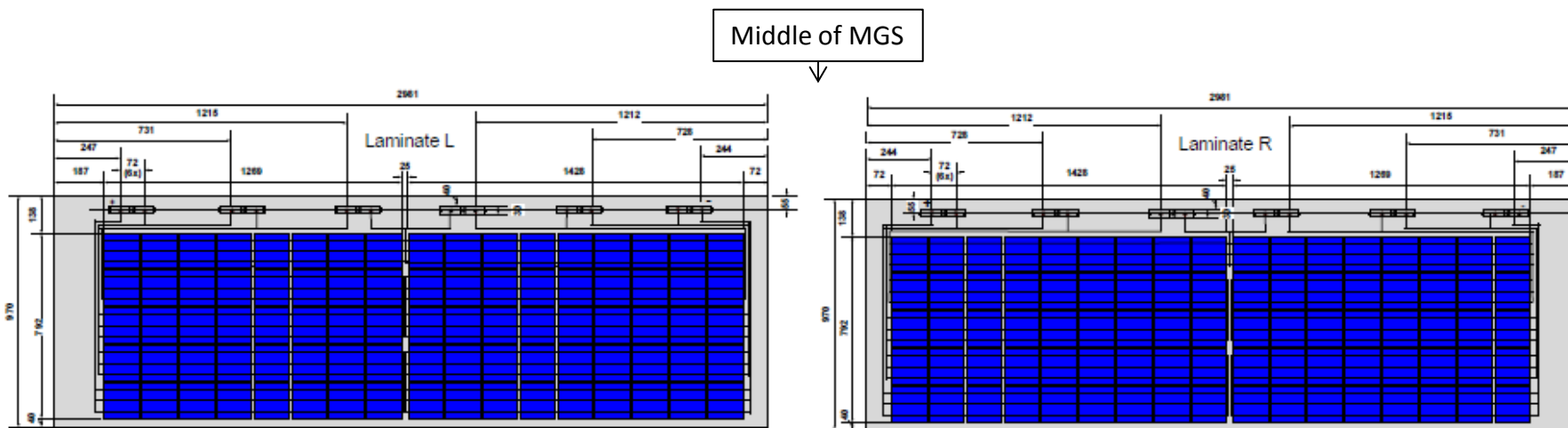
- Bypass diodes and junction boxes are critical components in many PV technologies
- This is even more the case for bifacial technology because of the higher currents, and limited availability of components
- Two options have been investigated
 - A. Inlaminated diodes; flexible in design but too limited current
 - B. Special high diode and current junction box; holes in glass required, current rating 20 A
- Current ratings and temperatures for option B have been experimentally verified, and the option is approved

Critical Aspects: Graffiti



- Graffiti is permanent and will very severely reduce yield
- The most solid approach against it seems a regular cleaning service; frequency and costs to be determined
- The cleaning demand might be reduced by means of (existing) anti-graffiti coatings; PV and other properties need to be investigated: transparency, reflection, effectiveness, durability

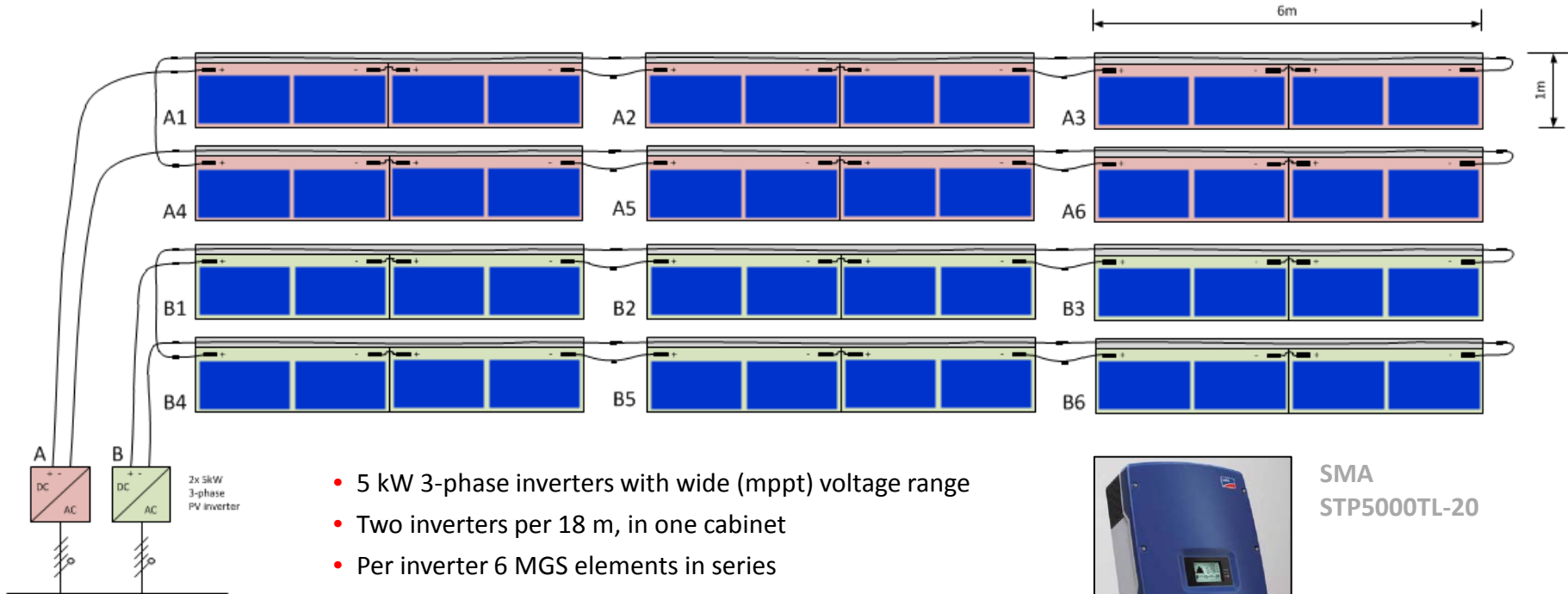
Final Design MGS-PV: Laminates



- Maximum number of cells for non-critical spacing
- Empty surface area preferentially on top and near poles
- Single-diode junction boxes, mounted on glass

- Two mirror-image laminates per one MGS element
- Vertical support stud added in middle of MGS element

Final Design MGS-PV: System



- 5 kW 3-phase inverters with wide (mppt) voltage range
- Two inverters per 18 m, in one cabinet
- Per inverter 6 MGS elements in series
- Cable duct at top of each MGS element



SMA
STP5000TL-20

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