



SKiiP stack

SKiiPRACK® - Type 6A

4-Quadrant 3-phase IGBT converter

Ordering No. 08800600

Description SKS C 240 GDD 69/11 – A6A MA B1C

Features

- Designed in regard to EN50178 recommendations
- Designed for a 1200 x 600 x 2000 mm cabinet
- Embedded SKiiP® Technology 3
- SKiiP 2403GB172-4DW, Trench 3 1700V IGBT, CAL3 diode
- Integrated current and temperature sensors
- Water cooling

Typical Applications

- Wind generators (SG and DFIG)
- High power AC drives

Footnotes

¹⁾ Absolute maximum ratings are values not to be exceeded in any case and do not imply that the stack can operate in all these conditions taken together

²⁾ fan consumption and losses in air included

REMARKS

This technical information specifies semiconductor devices but promises no characteristics. No warranty or guarantee, expressed or implied is made regarding delivery, performance or suitability.

Before using the converter, please read carefully the SKiiPRACK® user manual.

Absolute maximum ratings		Values		Unit
Symbol	Conditions	min	typ	max
I _{IN MAX}	Maximum permanent input current	2 400		A _{RMS}
I _{OUT MAX}	Maximum permanent output current	2 400		A _{RMS}
V _{IN MAX}	Maximum input voltage	760		V _{AC}
V _{OUT MAX}	Maximum output voltage	760		V _{AC}
V _{BUS MAX}	Maximum DC Bus voltage	1 200		V _{DC}
F _{IN MAX}	Inverter input frequency	100		Hz
F _{OUT MAX}	Inverter output frequency	100		Hz
F _{SW MAX}	Maximum switching frequency	5		kHz

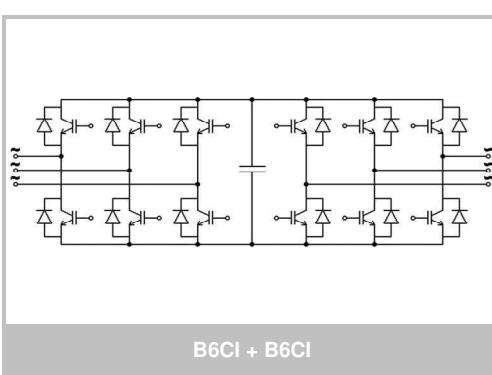
Electrical characteristics		T _{AMBIENT} = 40°C unless otherwise specified		
Symbol	Conditions	min	typ	max

AC phase Grid		T _{AMBIENT} = 40°C unless otherwise specified		
Symbol	Conditions	min	typ	Unit
I _{OUT RATED}	Rated output current	2 400		A _{RMS}
I _{OUT OVL}	Overload output current	2 640		A _{RMS}
t _{OVL}	Overload duration	60		s
T _{OVL}	Time between 2 overloads	10		min
V _{OUT}	Output voltage	620	690	760
P _{OUT}	Rated output power	2 870		kW
F _{SW}	Inverter switching frequency	2		kHz
F _{OUT}	Output frequency	50		Hz
PF	Power factor	1		-
P _{LOSS INV} ²⁾	Losses at rated current	28 320		W
η ²⁾	Efficiency at rated current	99		%

AC phase Generator		T _{AMBIENT} = 40°C unless otherwise specified		
Symbol	Conditions	min	typ	Unit
I _{IN RATED}	Rated input current	2 400		A _{RMS}
I _{IN OVL}	Overload input current	2 640		A _{RMS}
t _{OVL}	Overload duration	60		s
T _{OVL}	Time between 2 overloads	10		min
V _{OUT}	Output voltage	620	690	760
P _{OUT}	Rated output power	2 870		kW
F _{SW}	Inverter switching frequency	2		kHz
F _{OUT}	Output frequency	20	100	Hz
PF	Power factor	-1		-
P _{LOSS INV} ²⁾	Losses at rated current	28 320		W
η ²⁾	Efficiency at rated current	99		%

DC Bus		T _{AMBIENT} = 40°C unless otherwise specified		
Symbol	Conditions	min	typ	Unit
V _{BUS}	Rated DC voltage applied to the capacitor bank	1 100		V _{DC}
V _{BUS MAX}	Max DC voltage applied to the caps bank (max 30% of LTE)	1 200		V _{DC}
τ _{d5%}	Discharge time of the capacitors (V _{DC} < 60 V)	6		min
C _{DC}	Capacitor bank capacity	27,0		mF
LTE	Calculated LTE of the capacitors with forced air cooling	100		kh

Stack Insulation		T _{AMBIENT} = 40°C unless otherwise specified		
Symbol	Conditions	min	typ	Unit
Crd	Minimum creepage distance	8,7		mm
Cld	Minimum clearance distance	7,1		mm
Visol	Chassis / Power stage AC/DC (insulation test voltage DC, 5 s)	-4 200	4 200	V _{DC}
Visol12	SKiiP driver only, output 1 / output 2 (AC, rms, 2 s)	1 500		V
dv/dt	SKiiP driver only, secondary to primary side	75		kV/μs





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SKiiPRACK® - Type 6A 4-Quadrant 3-phase IGBT converter

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- Embedded SKiiP® Technology 3
- SKiiP 2403GB172-4DW, Trench 3 1700V IGBT, CAL3 diode
- Integrated current and temperature sensors
- Water cooling

Typical Applications

- Wind generators (SG and DFIG)
- High power AC drives

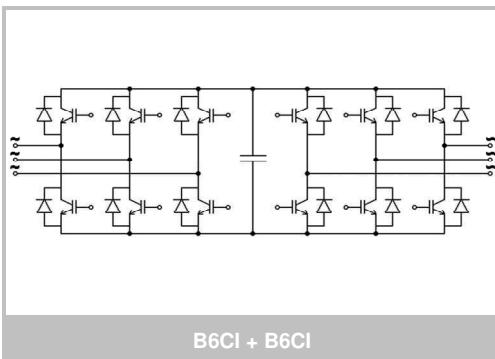
Footnotes

¹⁾ the user shall ensure that the ambient air is sufficiently ventilated to avoid hot spots.

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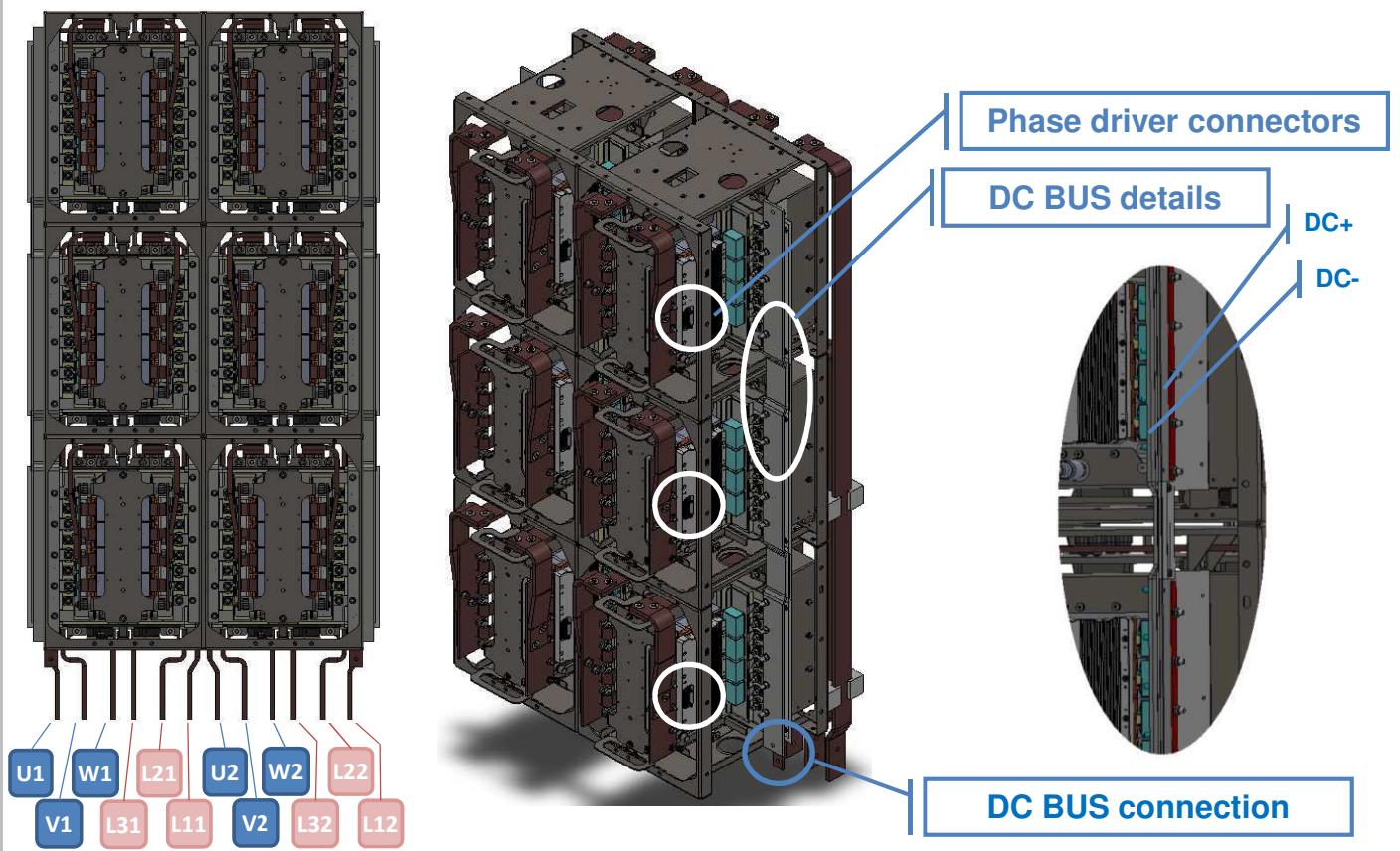
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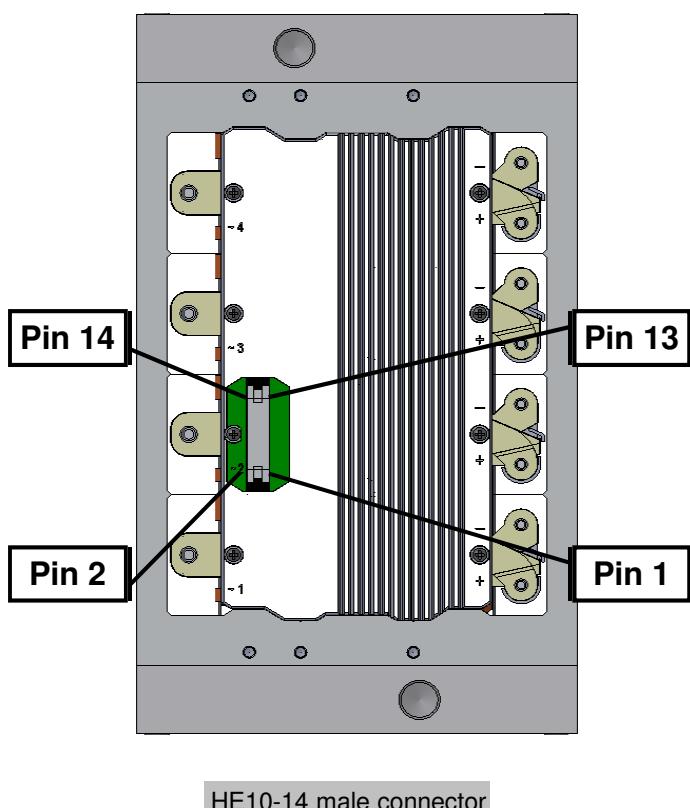
Characteristics	Conditions	$T_{AMBIENT}=40^{\circ}\text{C}$ unless otherwise specified			
		min	typ	max	Unit
Climatic					
Ambiant temperature 1)	IEC 60721-3, class 1K2 & 2K2 Storage & transportation	-25	60		°C
	IEC 60721-3-3, class 3K3 extended In operation	-20	55		°C
Humidity	IEC 60721-3-3, class 3K3 no condensation no icing	5	85		%
Mechanical					
Installation altitude	without derating	1 000		m	
Max. installation altitude	with derating	4 000		m	
Protection degree	IEC 60529	IP00		-	
Vibrations & Shocks	IEC 60721-3-2, storage & transportation, 1 cell	2M1		-	
	IEC 60721-3-3, in operation, 1 cell	3M3		-	
Pollution degree	EN 50178	2		-	
Mass	Cell	80		kg	
	4-Quadrant converter	550		kg	
Thermal					
$\Delta V/\Delta t_{WATER}$	Water flow per cell	8	12	24	L/min
	Water flow per 4Q-converter	48	72	144	L/min
ΔP_{WATER}	Pressure drop per cell with male and female connectors, 50% glycol, 12 L/min	150		mbar	
	Pressure drop per 4Q converter with male and female connectors, 50% glycol, 72 L/min	150		mbar	
Water pressure	Maximum water pressure permissible per cell	3		bar	
Coolant type	Recommended coolant	50% Glycol / 50% water		-	
T_{INLET}	Cooling water inlet temperature	-20	45	60	°C
External cooling airflow	Snubbers, required airflow direction bottom-top	1		ms ⁻¹	
V_{SUPPLY} [fan]	Capacitor DC fan operating voltage	18	24	28	V _{DC}
P_{FAN} per fan	Fan power consumption at typical voltage supply	3,6		W	
LTE [fan]	Capacitor DC fan life time expectancy (L10 method)	65		kh	

Symbol	Conditions	$T_{AMBIENT}=25^{\circ}\text{C}$ unless otherwise specified			
		min	typ	max	Unit
Gate Driver Characteristics					
V_{S2}	supply voltage non stabilized	13	24	30	V _{DC}
I_{S2}	$V_{S2} = 13\text{ V} - 30\text{ V}$, F_{SW} in kHz, I_{AC} in A	330 + 55 × F_{SW} + 0.00035 × I_{AC}^2			mA
V_{iT+}	input threshold voltage HIGH	12,3			V _{DC}
V_{iT-}	input threshold voltage LOW		4,6		V _{DC}
R_{IN}	Input resistance	10			kΩ
C_{IN}	Input capacitance	1			nF
Measurement & protection					
HB_I	Analogue current signal HB_I	245	250	255	A.V ¹
I_{TRIPSC}	over current trip level (analog OUT=10V)	2 450	2 500	2 550	A _{PEAK}
CMN_TMP	Analogue temperature signal Th < 80°C	min typ max	17 + 10,3 × CMN_TMP 19 + 10,5 × CMN_TMP 20 + 10,5 × CMN_TMP		°C
CMN_TMP	Analogue temperature signal Th > 80°C	min typ max	26 + 8,8 × CMN_TMP 28 + 8,8 × CMN_TMP 30 + 8,9 × CMN_TMP		°C
T_{trip}	Over temperature protection	110	115	120	°C

Electrical connection



Phase Driver connector assignment

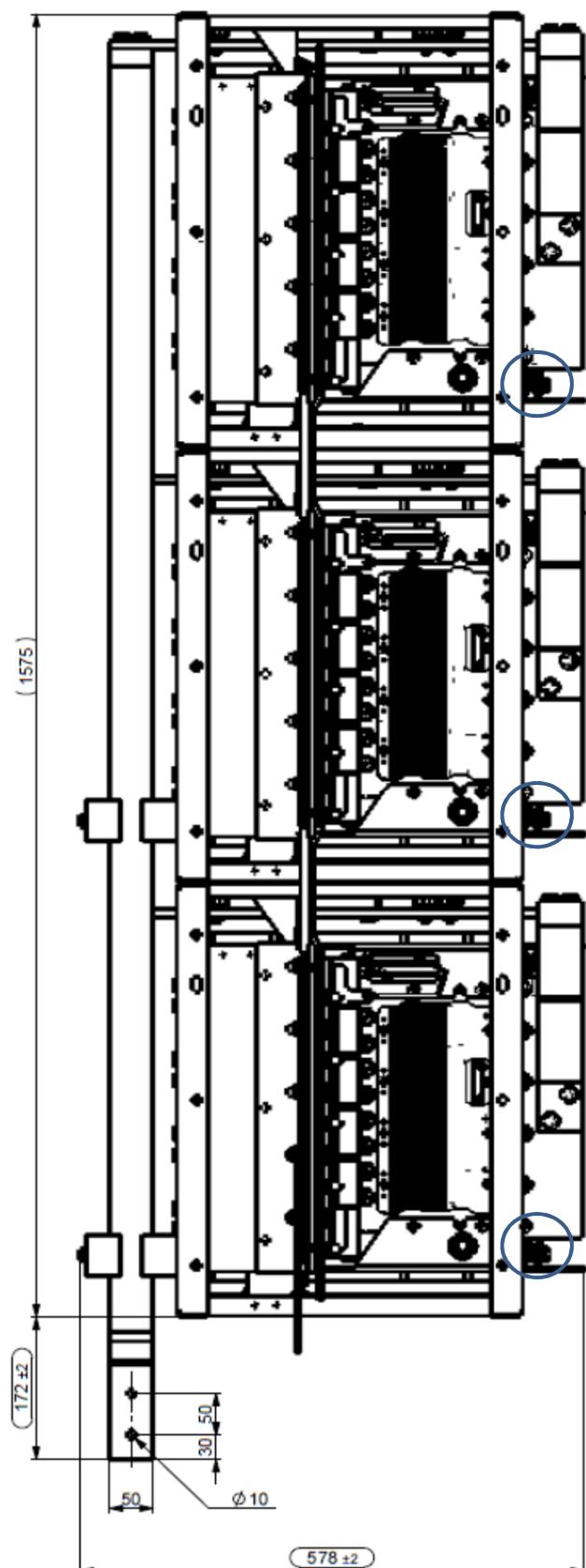


HE10-14 male connector

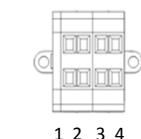
X1U•, X1V•, X1W•, X1L1•, X1L2•, X1L3•

Pin	Signal	Remark
1	Shield	
2	BOT IN (2)	positive 15V CMOS logic; 10 kΩ impedance, don't connect when using fiber optic
3	ERROR OUT (1)	LOW = NO ERROR; open Collector Output; max. 30 V / 15 mA don't connect when using fiber optic, propagation delay 1 μs min. pulselwidth error-memory-reset 9 μs
4	TOP IN (2)	positive 15V CMOS logic; 10 kΩ impedance don't connect when using fiber optic
5	Overtemp. OUT (1)	LOW = NO ERROR = $\theta_{DCB} < 115 + 5^\circ\text{C}$ open collector Output; max. 30 V / 15 mA „low“ output voltage < 0,6 V „high“ output voltage max. 30 V
6	+ 24 VDC IN	24 V _{DC} supply
7	+ 24 VDC IN	24 V _{DC} supply supply voltage monitoring threshold 19,5 V
8	+ 15 VDC OUT	max. 50 mA auxiliary power supply
9	+ 15 VDC OUT	
10	GND	GND for power supply and
11	GND	GND for digital signals
12	Temp. analog OUT	max output current 5mA
13	GND aux	reference for analog output signals
14	I analog OUT	SKiiP 3 with Al ₂ O ₃ ceramic substrate current actual value 8,0 V \leftrightarrow 100 % IC @ 25 °C overcurrent trip level 10 V \leftrightarrow 125 % IC @ 25 °C current value > 0 \Rightarrow SKiiP system is source current value < 0 \Rightarrow SKiiP system is sink SKiiP 3 with AlN ceramic substrate: refer to corresponding datasheet

1) Open collector output, external pull up resistor necessary
added signal to GND



LEFT SIDE VIEW

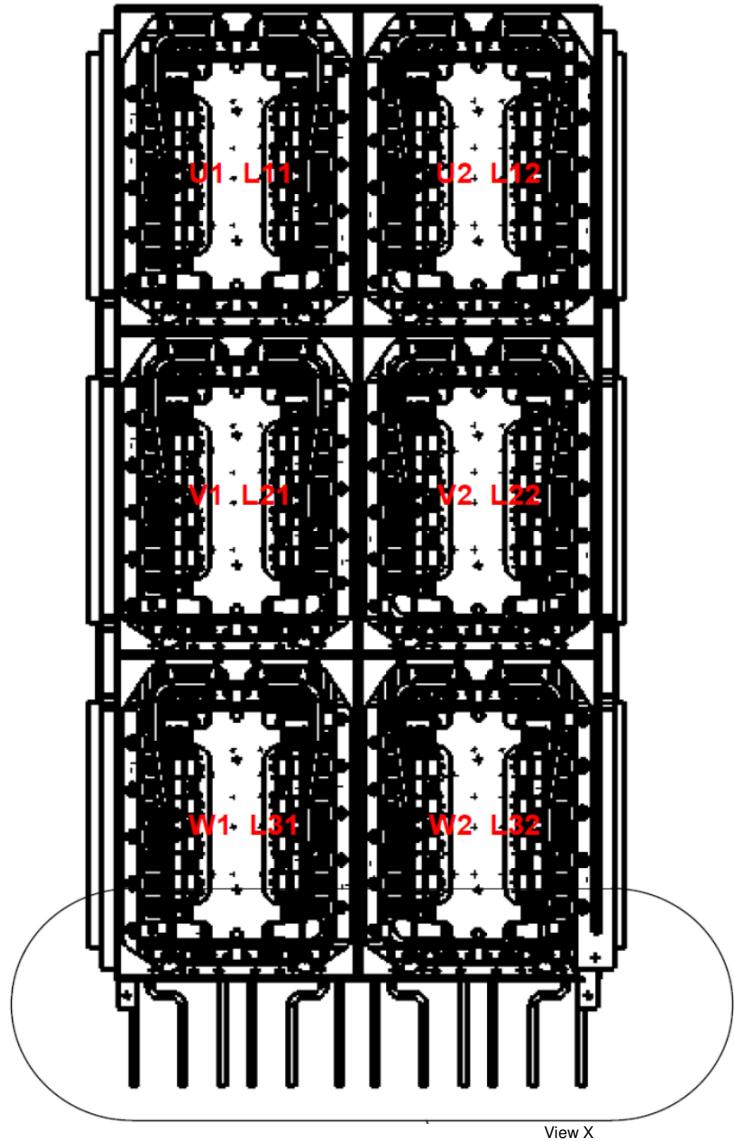


Pin	Designation
1	+24VDC
2	+24VDC
3	GND
4	GND

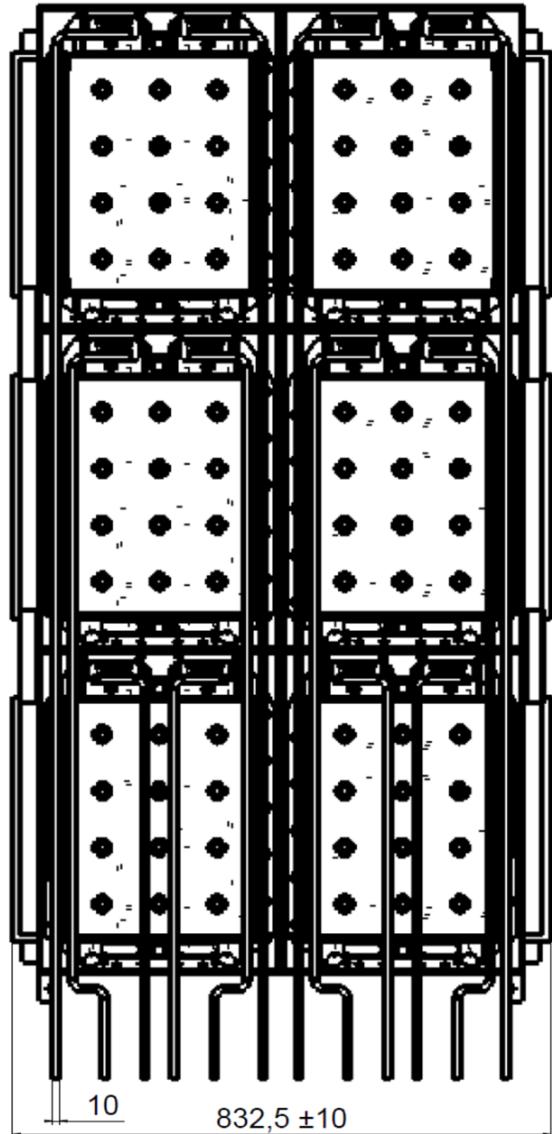
DC FAN CONNECTION (6 times)

Dimensions

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FRONT VIEW

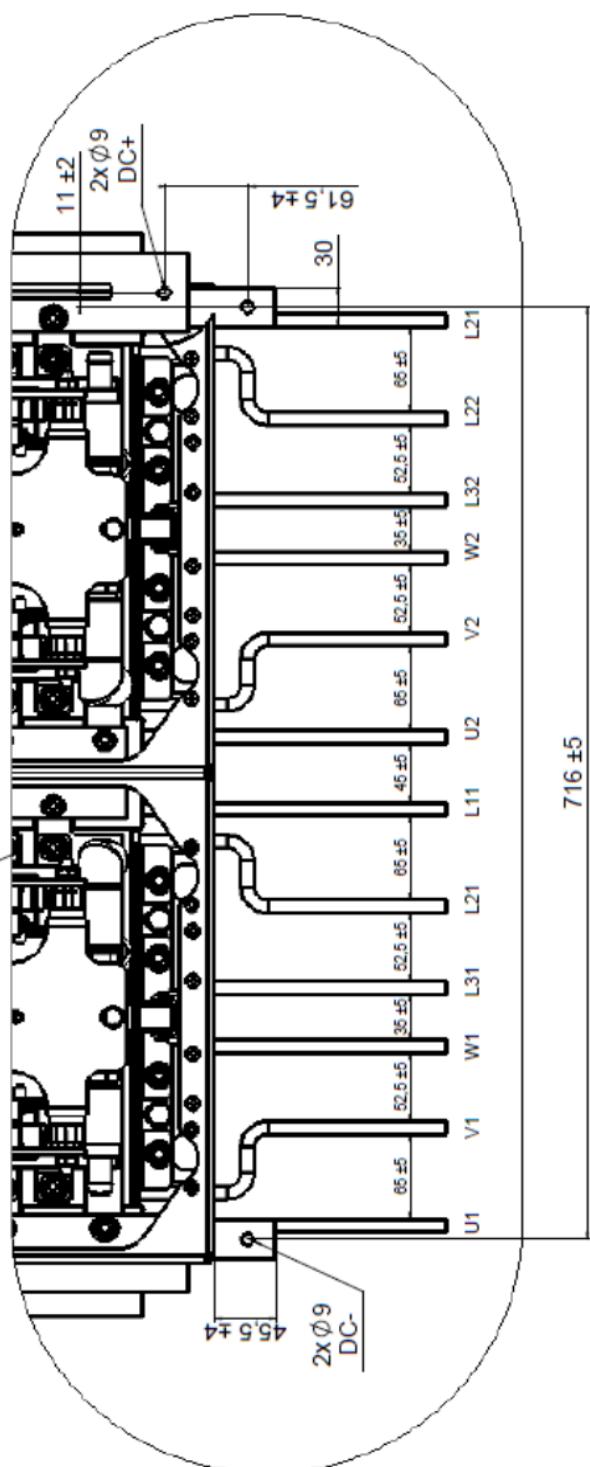


REAR VIEW

U, V, W are generator side converter phases
L1, L2, L3 are grid side converter phases
2 SKiiPs in parallel cannot be on the same SKiiPRACK cell

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Details - View X

Dimensions

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