



SKiiP stack

SEMISTACK® Renewable Energy - Size W1

Two Quadrant 3-phase IGBT inverter

Ordering No. 08800136

Description SKS B1 090 GD 69/11 - MA PB

Features

- Designed in regard to EN50178 and UL508C recommendations
- Designed for a 600 x 600 x 2000 mm cabinet
- Embedded SKiiP® Technology 3
- SKiiP 1513GB172-3DW, Trench 3 1700V IGBT, CAL3 diode
- Integrated current and temperature sensors
- Water cooling

Typical Applications

- Wind generators (SG and DFIG)
- Solar Inverters

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

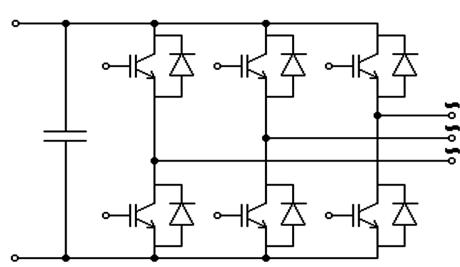
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Absolute maximum ratings ¹⁾		Values		Unit
Symbol	Conditions	min	typ	max
I _{OUT MAX}	Maximum permanent output current	900		A _{RMS}
I _{IN MAX}	Maximum permanent input current	1 800		A _{DC}
V _{OUT MAX}	Maximum output voltage	760		V _{AC}
V _{BUS MAX}	Maximum DC Bus voltage	1 200		V _{DC}
F _{OUT MAX}	Inverter output frequency	100		Hz
F _{SW MAX}	Maximum switching frequency	5		kHz

Electrical characteristics: application example		T _{AMBIENT} =40°C unless otherwise specified			
Symbol	Conditions	min	typ	max	
AC phase					
V _{BUS}	DC bus rated voltage	1 100		V _{DC}	
I _{OUT RATED}	Rated output current	900		A _{RMS}	
V _{OUT}	Output voltage	620	690	760	V _{AC}
P _{OUT}	Rated output power	1 080		kW	
F _{SW}	Inverter switching frequency	2		kHz	
F _{OUT}	Output frequency	50		Hz	
PF	Power factor	-1	1	-	
P _{LOSS INV} ²⁾	Losses at rated current	10 900		W	
η ³⁾	Efficiency at rated current	99		%	

DC Bus				
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)	5		min
C _{DC}	Capacitor bank capacity	7,6		mF
LTE	Calculated LTE of the caps with forced air cooling	100		kh

Stack Insulation				
CrD	Minimum creepage distance	11		mm
ClD	Minimum clearance distance	9.4		mm
Visol	Chassis / power stage AC/DC (insulation test voltage DC, 5s)	-4 200	4 200	V _{DC}
dv/dt	SKiiP driver only, secondary to primary side	75		kV/μs



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³⁾ the user shall ensure that the ambient air is sufficiently ventilated to avoid hot spots.

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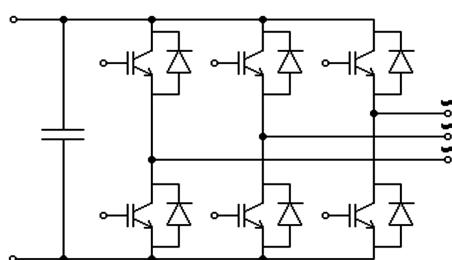
Characteristics	Conditions	T _{AMBIENT} =40°C unless otherwise specified			
		min	typ	max	Unit
Climatic					
Ambient temperature ³⁾	Storage: IEC 60721-3-1, class 1K2 Transportation: IEC 60721-3-2, class 2K2	-25	60		°C
	Operation: IEC 60721-3-3, class 3K3 extended	-20	55		°C
Humidity	IEC 60721-3-3, class 3K3 no condensation no icing	5	85		%
Mechanical					
Installation altitude	without derating	1 000		m	
Max installation altitude	with derating	4 000		m	
Ingress protection	IEC 60529	IP00		-	
Vibrations & Shocks	IEC 60721-3-2, Storage & transportation	2M1		-	
	IEC 60721-3-3, in operation	3M3		-	
Pollution degree	EN 50178	2		-	
Mass	3-phase inverter, with cable plate terminal and no DC bus connection	85		kg	

Thermal data

$\Delta V/\Delta t_{WATER}$	Water flow of the 3-phase inverter	8	16	35	L/min
ΔP_{WATER}	Water pressure drop of the inverter, with male and female connectors, 50% glycol, 16 L/min	310		mbar	
Water pressure	Rated water pressure per inverter	3		bar	
Coolant type	Recommended coolant	50% glycol / 50% water		-	
T _{INLET}	Cooling water inlet temperature	-20	45	60	°C
Required cooling airflow	Airflow direction bottom to top on snubbers ³⁾	1		m.s ⁻¹	
V _{SUPPLY}	Fan DC voltage supply	16	24	30	V _{DC}
P _{FAN}	Fan power consumption at typical voltage supply	90		W	
LTE	Capacitor DC fan lifetime expectancy (L10 method)	57		kh	

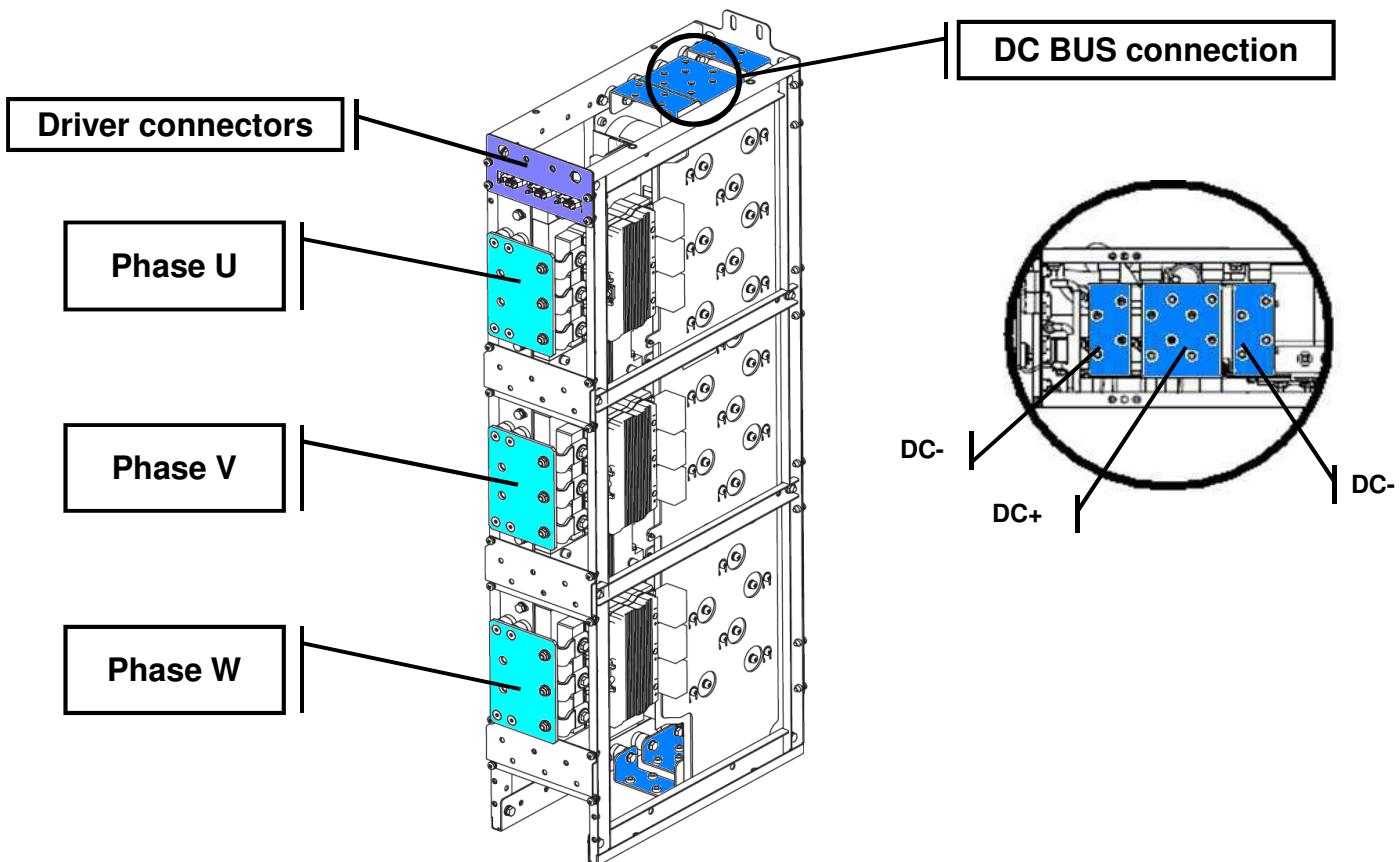
Gate Driver Characteristics

Symbol	Conditions	T _{AMBIENT} =25°C unless otherwise specified			
		min	typ	max	Unit
Gate Driver / controller data					
V _S	supply voltage non stabilized	13	24	30	V
I _S	V _{S2} = 24 V, F _{sw} in kHz, I _{RMS} in A	300 + 42 × F _{sw} + 0.00044 × I _{RMS} ²			mA
V _{IT+}	input threshold voltage HIGH	12.3			V
V _{IT-}	input threshold voltage LOW		4.6		V
R _{IN}	Input resistance	10			kΩ
C _{IN}	Input capacitance	1			nF
Measurement & protection					
HB_I	Analogue current signal HB_I	184	188	191	A.V ⁻¹
I _{TRIP SC}	Over current trip level (I _{analogue OUT} =10V)	1 837	1 875	1 912	A _{PEAK}
CMN_TMP	Analogue temperature signal Th < 80°C	min 17 + 10.3 × CMN_TMP	typ 19 + 10.5 × CMN_TMP	max 20 + 10.5 × CMN_TMP	°C
CMN_TMP	Analogue temperature signal Th > 80°C	min 26 + 8.8 × CMN_TMP	typ 28 + 8.8 × CMN_TMP	max 30 + 8.9 × CMN_TMP	°C
T _{TRIP}	Over temperature protection	110	115	120	°C

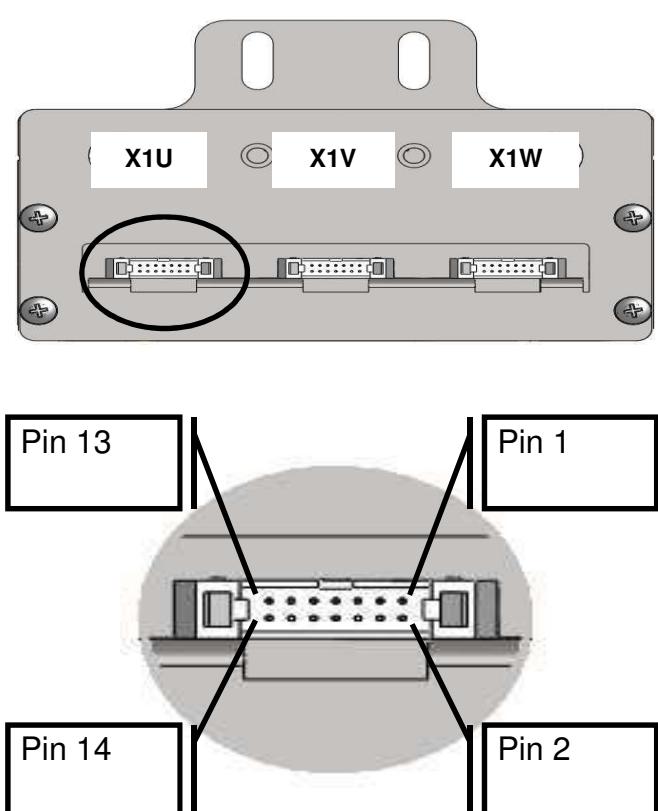


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Electrical connection



Drive connector assignment



X1U, X1V, X1W

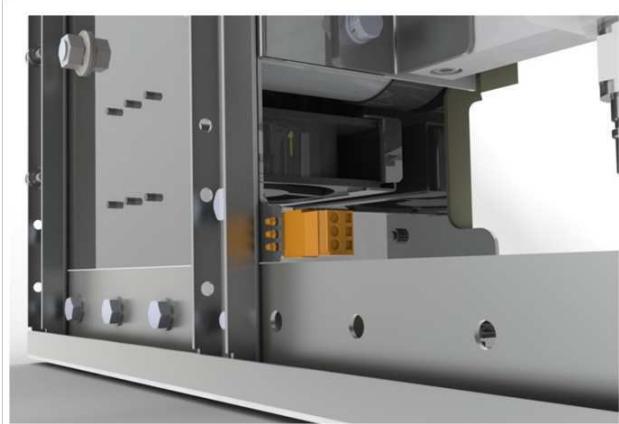
Pin	Signal	Remark
1	Shield	
2	BOT IN (2)	positive 15V CMOS logic; 10 kΩ impedance, don't connect when using fiber optic
3	ERROR OUT (1)	LOW = NO ERROR; open Collector Output; max. 30 V / 15 mA don't connect when using fiber optic, propagation delay 1 µs min. pulselwidth error-memory-reset 9 µs
4	TOP IN (2)	positive 15V CMOS logic; 10 kΩ impedance don't connect when using fiber optic
5	Overtemp. OUT (1)	LOW = NO ERROR = 9DCB < 115 + 5°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 VDC (SKiiP 2: 20 - 30 V, SKiiP 3: 13 - 30 V)
7	+ 24 VDC IN	don't supply with 24V, when using +15 VDCIN supply voltage monitoring threshold 19,5 V
8	+15 Vdc OUT	max. 50 mA auxiliary power supply when SKiiP system is supplied via pin 6/7
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 Al2O3 ceramic substrate current actual value 8,0 V ⇔ 100 % IC @ 25 °C overcurrent trip level 10 V ⇔ 125 % IC @ 25 °C current value > 0 ⇔ SKiiP system is source current value < 0 ⇔ 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

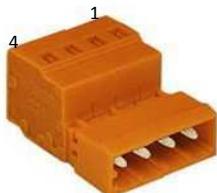
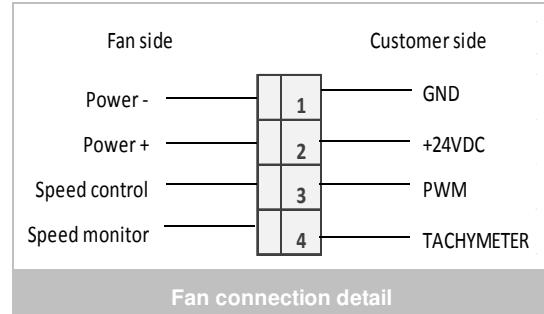
HE-10 14 pin male connector

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DC fan connection

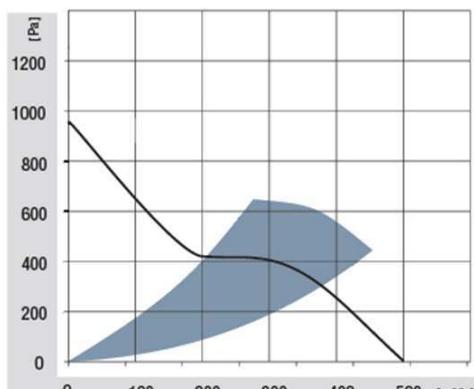


Fan connection detail

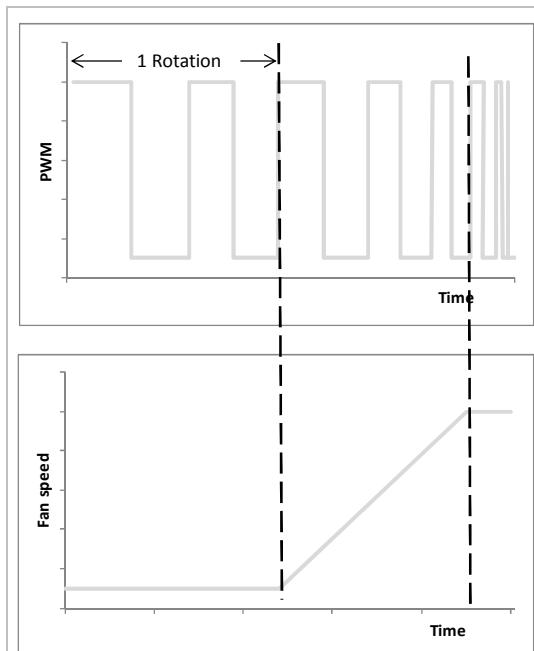


Pin	Designation
1	GND
2	+24VDC
3	PWM
4	MONITOR

DC fan speed control

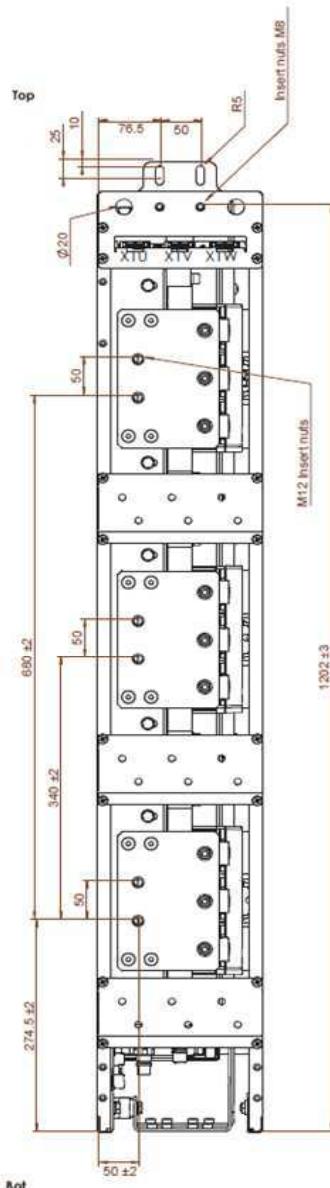
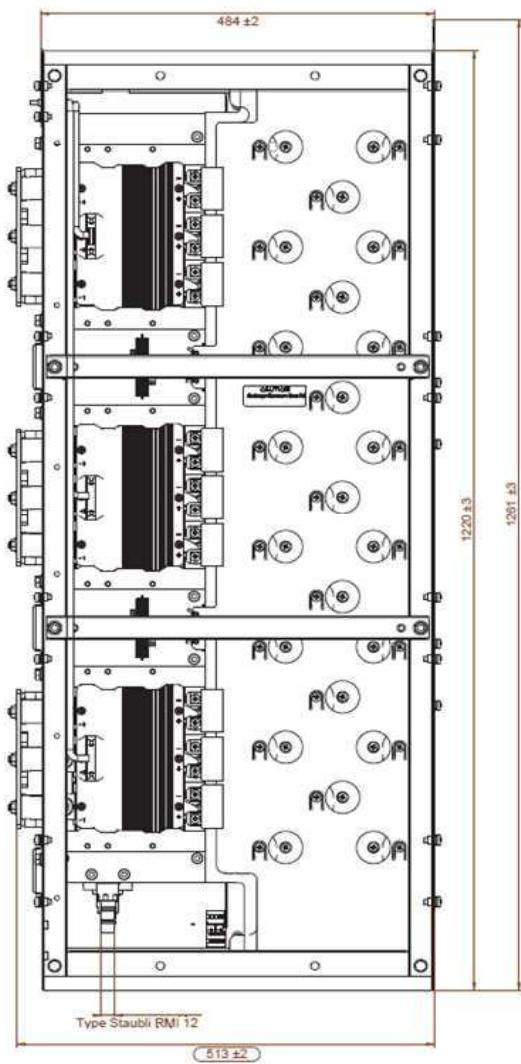
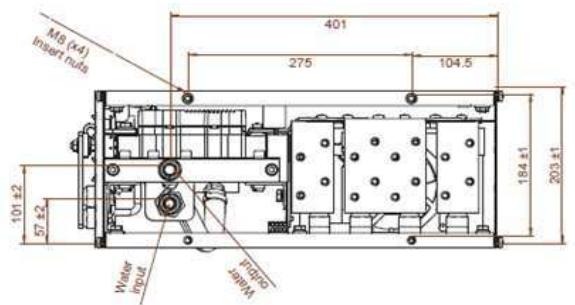


Characteristic pressure drop vs air flow

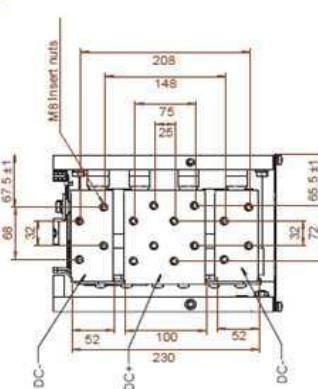
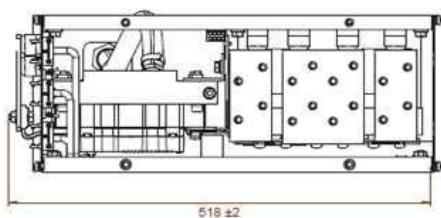


Speed control behavior

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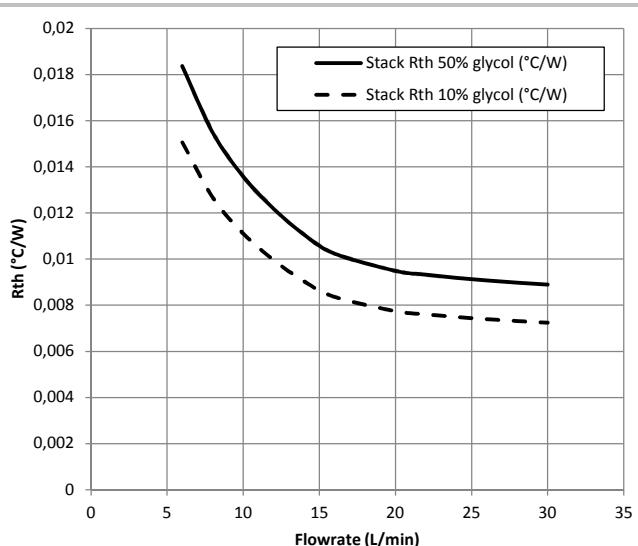


Detail connection DC+/-

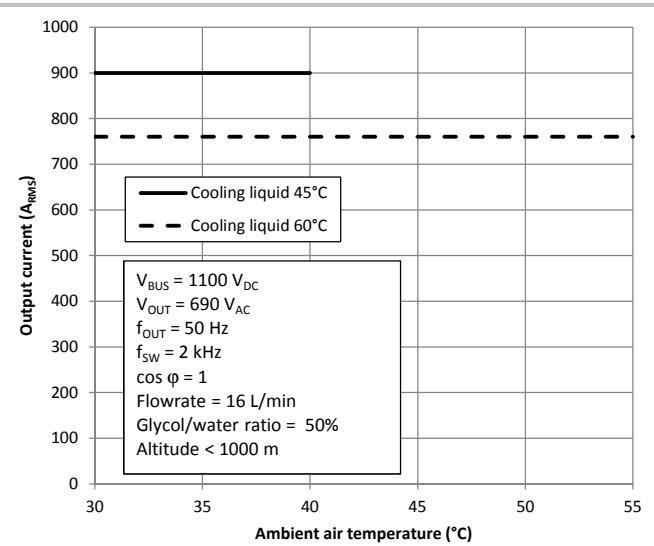


Dimensions

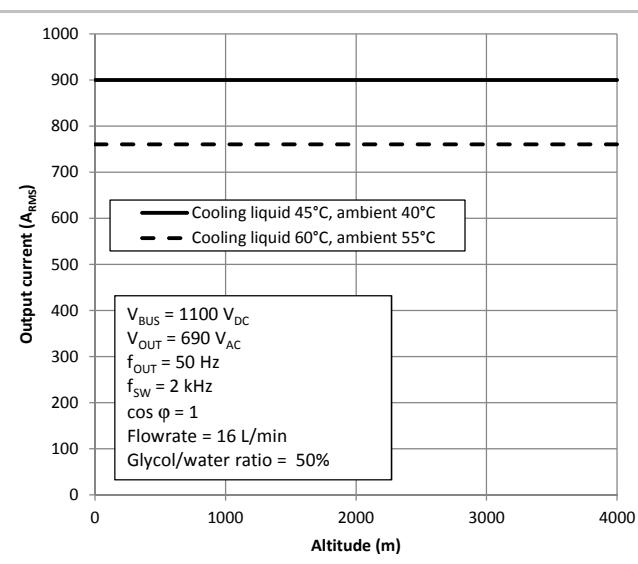
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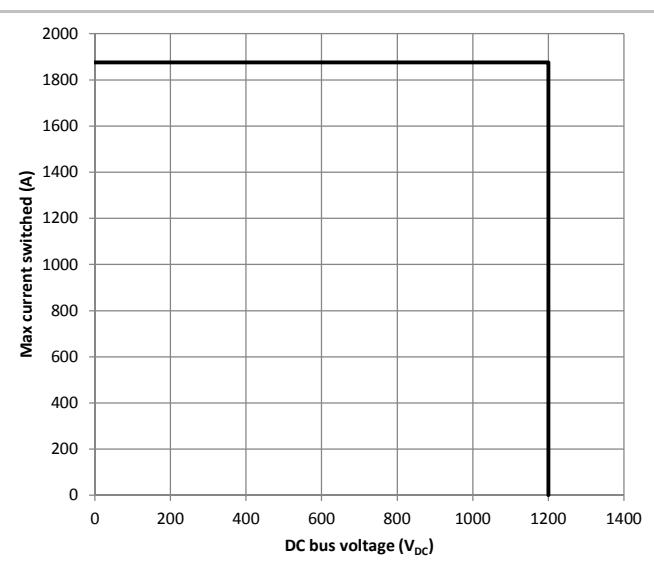
Rth_{Sink-Water(stack)} vs. Liquid Flow



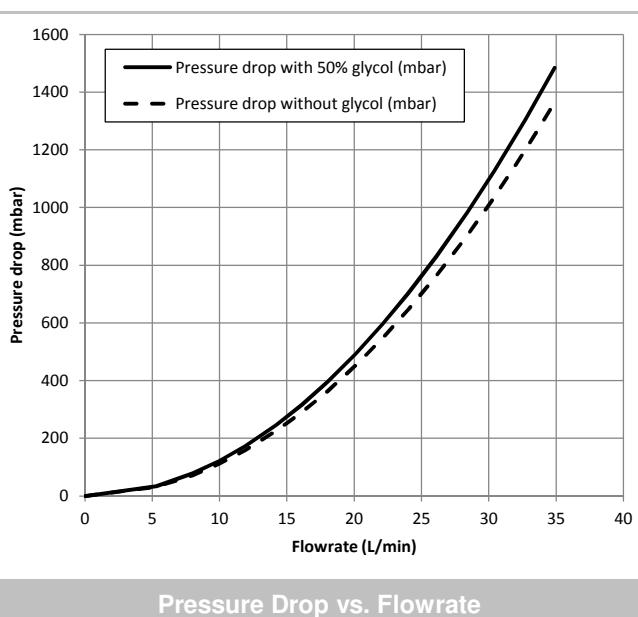
Permanent Output Current vs. Ambient Temperature



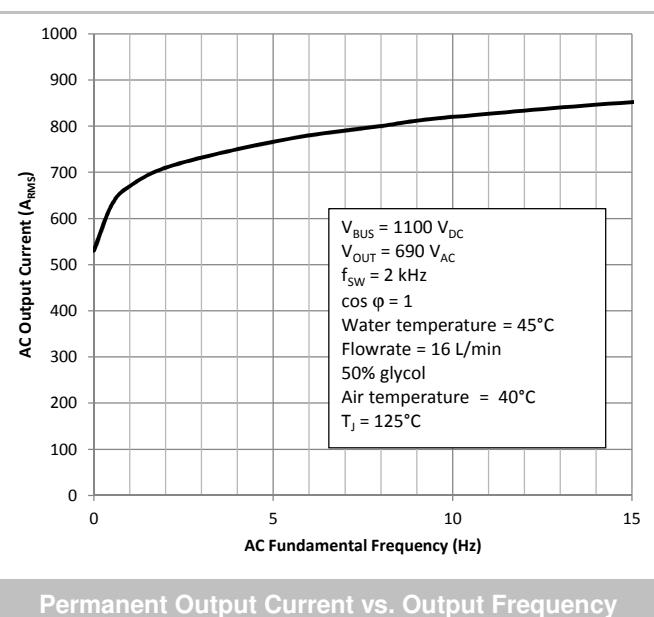
Permanent Output Current vs. Altitude



Safe Operating Area



Pressure Drop vs. Flowrate



Permanent Output Current vs. Output Frequency