DNV·GL

Certificate No:
TAE00003K1

TYPE APPROVAL CERTIFICATE

This is to certify:

That the Circuit Breaker

with type designation(s)
DC-Breaker

Issued to
Astrol Electronic AG
Othmarsingen, AG, Switzerland

is found to comply with
DNV GL rules for classification – Ships, offshore units, and high speed and light craft

Application :

Products approved by this certificate are accepted for installation on all vessels classed by DNV GL.

Type	Rated voltage (V)	Rated current (A)
DC-Breaker	1500 DC	500
DC-Breaker	1500 DC	1250

This Certificate is valid until **2024-10-23**.

Issued at **Høvik** on **2019-10-24**

DNV GL local station: **Rotterdam, Product Certification /Verification**

for **DNV GL**

Approval Engineer: **Nicolay Horn**

Trond Sjåvåg
Head of Section

This Certificate is subject to terms and conditions overleaf. Any significant change in design or construction may render this Certificate invalid.
The validity date relates to the Type Approval Certificate and not to the approval of equipment/systems installed.

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Job Id: **262.1-023963-1**
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Name and place of manufacturer

Astrol Electronic AG
Ahornweg 14
CH-Othmarsingen, Switzerland

Product description

Astrol DC-Breaker fast-current cutter/DC-bus tie device

Astrol DC-Breaker Model Types:

Ident number	Description	Nominal current	Size	No. Modules
AA-10411-101	DC-Breaker 0.5-1kV	500 A	Small	1
AA-10411-102	DC-Breaker 1.25-1kV	1250 A	Medium	1

General Specification				
Parameter	Min	Max	Unit	Notes
DC Link voltage $V_{dc\ link}$	10	1500	V_{pc}	
DC Link voltage nominal current $I_{dc\ link}$	0.5	5	kA	
System loop inductance $L_{dc\ link}$	-	100	µH	1
Breaking time t_{break}	-	10	µs	3
Breaking current I_{break}	-	20	kA	3
Clearance time $t_{clearance}$	-	TBD	µs	2,3
Link lenght L_{link}	-	100	m	4
24V link power P_{24V}	-	260	W	
Ambient temperature Tamb	÷ 25	+ 60	°C	
Tap water temperature	-	+ 50	°C	4
Humidity		95	%RH	5
IP grade electronic		IP54		
IP grade switch		IP54		

1. System inductance is not limiting factor but does have influence on overvoltage protection
2. Depends on customer system (inductance, voltage, current)
3. See also table section 2.7 on page 16 in Astrol document « Design Description Astrol DC-Breaker Family» doc. no AA-10811-010 Rev.1.8
4. Tap water or deionized water is applicable, for details see doc. No. AA-10411-xxx section 13.1
5. Non condensating

Software Package	Comicon FPGA	Comicon CPU	MU4HV	GDU	CU4FAN
DC-Breaker	1.09	1.24	1.01	1.00	1.00

Application/Limitation

The DC Breaker is a (bi-)directional, fault current suppressor based on current interruption by switching of IGBT transistors. This type approval is applicable for a directional and bi-directional peer-to-peer configuration.

The device is tested in accordance with relevant class rules, and is found to be suitable for marine use.

The device is used for fault current suppression and does not replace circuit breakers or switches for isolation. The system design needs to be approved on a case by case basis, and must include, as part of the overall system arrangement:

- means for manual, local, operation independent of higher level automation system, enabling necessary means for local operation, local/remote change over, and interface for setting of parameters.
- means for monitoring and indication of operating status and alarms.

- means for isolation/switching, allowing operation, enabling access for repair and electrical maintenance, in accordance with relevant rule requirements.
- back-up protection (e.g. fuses) in accordance with relevant rule requirements (as applicable).
- documentation of required system discrimination.

Testing requirements:
Light load and non-destructive function testing, as well as verification of control system interface must be performed at system level during FAT. (These tests are not required during semiconductor module testing.)

Environmental parameters: Vibration A, Temperature B, Humidity B, EMC A

Type Approval documentation

Tests carried out

DC Breaker: Thermal test, Short circuit in two and three DC cables, Stop at full current and Bus tie cable overload detection. Power supply failure, Power supply variations, Voltage/frequency variation, Vibration, Dry heat, Damp heat, Insulation resistance, High voltage.

EMC: The following tests are in accordance with the DNVGL-CG-0339: Electrical fast transient (Burst), electrical slow transient (Surge), RF-common mode Voltage, radiated RF-electromagnetic fields, electric discharge (ESD), radiated and conducted emission. (See under application limitation).

Marking of product

Astrol – Type designation – DC Current – Short circuit current

Periodical assessment

The scope of the periodical assessment is to verify that the conditions stipulated for the Type approval are complied with and that no alterations are made to the product design or choice of materials.

The main elements of the assessment are:
- Inspection on factory samples, selected at random from the production line (where practicable)
- Results from Routine tests (RT) checked (if not available tests according to RT to be carried out)
- Review of type approval documentation
- Review of possible change in design, materials and performance
- Ensuring traceability between manufacturer's product type marking and Type Approval Certificate.

Assessment to be performed at 2 and 3.5 year and at renewal.

END OF CERTIFICATE