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LOW VOLTAGE

## **SACE Emax 2/ML**

Low-voltage air circuit breakers  
for naval applications



# SACE Emax 2/ML

## Robustness and reliability up to 20 g

A modern ship's operational ability is fully dependent on its onboard electrical infrastructure.

Over the years, the growth in the number of electrically powered subsystems on a typical naval vessel has made this infrastructure ever more complex and extensive, and has led to a steady increase in power requirements.

For over 50 years, ABB SACE has been building shockproof equipment for navies around the world. The considerable installed base of the

company's products on ships of the world's main navies underlines the reliability of ABB SACE electrical equipment.

Since the 1950s, the company has been manufacturing circuit breakers with special features not available on the same series of equipment destined for general use.

Based on this long experience, ABB SACE is proud to offer a new family of air circuit breakers for naval applications.

### Common data

Rated service voltage $U_e$	[V]	690	Number of poles	3
Rated insulation voltage $U_i$	[V]	1000	Version	Withdrawable
Rated impulse withstand voltage $U_{imp}$	[kV]	12	Automatic circuit breaker according to	IEC 60947-2
Frequency	[Hz]	50 - 60	Switch disconnector according to	IEC 60947-3



### Automatic circuit breakers

SACE Emax 2 /ML		E2.2 /ML			E4.2 /ML			E6.2 /ML	
Performance levels		N	S	H	N	H	V	H	V
		[A]	800	800	800	3200	3200	2000	4000 4000
		[A]	1250	1250	1250	4000	4000	2500	5000 5000
Rated uninterrupted current I <sub>u</sub> @ 40 °C		[A]	1600	1600	1600			3200	6300 6300
		[A]	2000	2000	2000			4000	
		[A]	2500	2500	2500				
		[A]							
Rated ultimate short-circuit breaking capacity I <sub>cu</sub>	400-415 V	[kA]	66	85	100	66	100	150	100 150
	440 V	[kA]	66	85	100	66	100	150	100 150
	500-525 V	[kA]	66	66	85	66	85	100	100 130
	690 V	[kA]	66	66	85	66	85	100	100 100
Rated service short-circuit breaking capacity I <sub>cs</sub>		[%I <sub>cu</sub> ]	100	100	100	100	100	100 <sup>(2)</sup>	100 100
Rated short-time withstand current I <sub>cw</sub>	(1s)	[kA]	66	66	85	66	85	100	100 100
	(3s)	[kA]	50	50	66	50	75 <sup>(3)</sup>	75	100 100
Rated short-circuit making capacity (peak value) I <sub>cm</sub>	400-415 V	[kA]	145	187	220	145	220	330	220 330
	440 V	[kA]	145	187	220	145	220	330	220 330
	500-525 V	[kA]	145	145	187	145	187	220	220 286
	690 V	[kA]	145	145	187	145	187	220	220 264
Utilization category (according to IEC 60947-2)			B	B	B	B	B	B	B
Breaking	Breaking time for I<I <sub>cw</sub>	[ms]	40	40	40	40	40	40	40 40
	Breaking time for I>I <sub>cw</sub>	[ms]	25	25	25	25	25	25	25 25

1) I<sub>cs</sub>: 50 kA for 400...440 V voltage2) I<sub>cs</sub>: 125 kA for 400...440 V voltage3) E4.2H 3200 A: 66 I<sub>cw</sub> (3 s)

### Switch-disconnectors

SACE Emax 2 /ML		E2.2 /ML		E4.2 /ML			E6.2 /ML	
Performance levels		N/MS	H/MS	N/MS	H/MS	V/MS	H/MS	X/MS
		[A]	800	800	3200	3200	2000	4000 4000
		[A]	1250	1250	4000	4000	2500	5000 5000
Rated uninterrupted current I <sub>u</sub> @ 40 °C		[A]	1600	1600			3200	6300 6300
		[A]	2000	2000			4000	
		[A]	2500	2500				
		[A]						
Rated short-time withstand current I <sub>cw</sub>	(1 s)	[kA]	66	85	66	85	100	100 120
	(3 s)	[kA]	50	66	50	75 <sup>(1)</sup>	75	100 100
Rated short-circuit making capacity (peak value) I <sub>cm</sub>	400-415 V	[kA]	145	187	145	187	330	220 264
	440 V	[kA]	145	187	145	187	330	220 264
	500-525 V	[kA]	145	187	145	187	220	220 264
	690 V	[kA]	145	187	145	187	220	220 264
Rated short-circuit making capacity (peak value) I <sub>cm</sub>			AC-23A	AC-23A	AC-23A	AC-23A	AC-23A	AC-23A

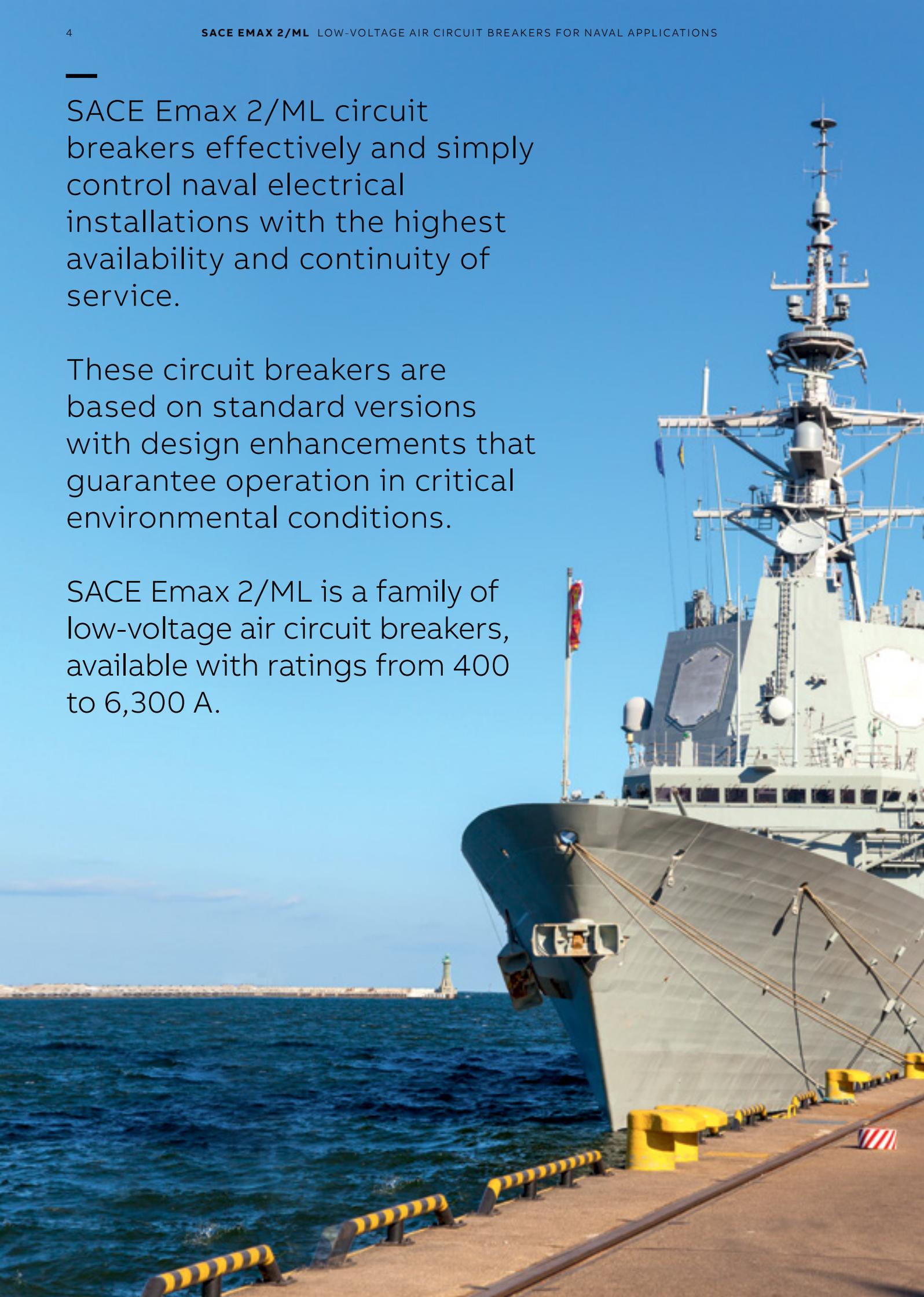
1) E4.2H/MS 3200 A: 66 kA I<sub>cw</sub> (3 s)

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SACE Emax 2/ML circuit breakers effectively and simply control naval electrical installations with the highest availability and continuity of service.

These circuit breakers are based on standard versions with design enhancements that guarantee operation in critical environmental conditions.

SACE Emax 2/ML is a family of low-voltage air circuit breakers, available with ratings from 400 to 6,300 A.



The low-voltage electrical distribution plants inside the modern ship are driven by these following growing need:

- Ensure service continuity by minimizing the time needed to identify and isolate faults
- Guarantee space optimization
- Optimize energy efficiency by analyzing energy consumption

#### **Reliability and service continuity**

SACE Emax 2 /ML is the most advanced and complete solution for ensuring service continuity.

With redundant actuators and communication modules built in, Emax 2 /ML takes electrical system reliability to new levels.

ABB's solution is the only one available that uses both a communication bus and electrical connections to prevent, detect and isolate electrical faults. Its unique "digital zone selectivity" function correctly identifies the fault zone faster and isolate it reducing the stress in the remaining active zone. As a result, the electrical protection is more robust and costly shutdowns are more effectively prevented.

Moreover SACE Emax 2 /ML features enhancements to the standard three-pole withdrawable circuit breaker that guarantee operation under stressful conditions:

- Shock resistance
- High temperatures and humidity range in a saline atmosphere; ML air circuit breakers can be used in ambient conditions where air temperature varies between -25 °C and +70 °C (-13 °F and +158 °F)
- Presence of vibrations that are persistent and have a high amplitude in specific frequency ranges

#### **Dimension and weight optimization**

SACE Emax 2 /ML is the most compact circuit breaker on the market, which makes it possible to reduce the size of circuit boxes up to 30%. SACE Emax 2 /ML circuit breakers offer maxi-

mum protection, best efficiency and ratings of up to 6,300 A.

The different levels of rated nominal current and breaking capacity levels have been studied to ensure optimal sizing for all ships' configurations. SACE Emax 2 /ML makes it possible to standardize the circuit-breaker support structures, considerably simplifying construction of the switchboards themselves.

SACE Emax 2 /ML offers the higher performances in the least space. Moreover, it allows optimal sizing of the installation and better protection of cables, busbar ducts and supports.

Less space is required in the switchgear and in the metal structures. The result is less oversizing, lower weight and, therefore, higher saving related to space optimization.

#### **Performance**

Next-generation ships will use more advanced microgrid technologies to overcome current power distribution challenges. Electrical distribution on a ship is an islanded microgrid, connecting multiple power generators and energy storage systems, that manages directional power flows. By using smart technologies to protect, connect and control the electrical system, ships can operate more efficiently and productively.

Emax 2 /ML low-voltage circuit breaker is the industry's first smart circuit breaker. Its embedded connectivity and load management software provides a comprehensive energy management solution. The load profile optimization functions of Emax 2 reduce CO<sub>2</sub> emissions and fuel costs. The innovative circuit breaker safeguards a ship's mission-critical loads and generators, using advanced adaptive protection to maximize productivity under all conditions.

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For your installations, choose the reliability, quality and experience of ABB.

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