New X1 by Emax.
The great little air circuit-

-breaker.

The X1 circuit-breaker by Emax comes from more than 60 years' experience of ABB SACE, a world leader in constructing moulded-case and air circuit-breakers. Our know-how, appreciated and recognised world-wide, has allowed us to obtain results which will amaze you. X1 by Emax is really small, powerful and safe. In fact, the search for extremely compact dimensions has not in any way affected the reliability and safety standards, because what counts most of all at ABB is the excellence of quality of our products.

The new X1 by Emax is revolutionary from all points of view. For example, the new rapid accessory fitting system: no wires inside the circuit-breaker, rapid and safe connection to the external circuit, and no screws for connection to the external power supply.

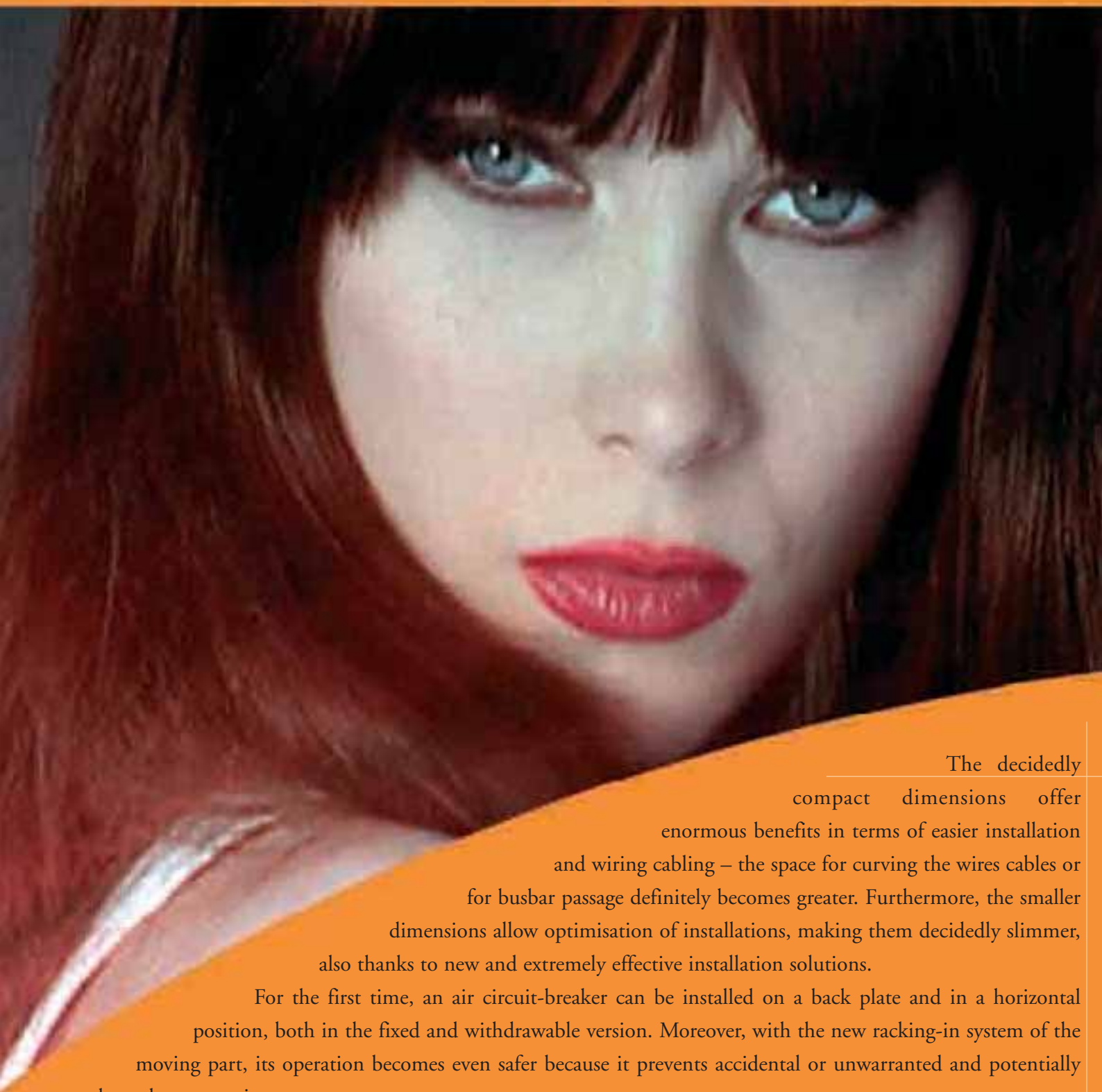
New X1 by Emax.
Small and powerful.

The performance of an air circuit-breaker with extremely compact dimensions. X1 by Emax is the best solution for all those applications where dimensions are an important and determining factor in selecting the circuit-breaker, but without necessarily having to give up high rated current, breaking capacity or short-time withstand current values.

Its performances are really astonishing when put in relation to its dimensions. Rated current Iu up to 1600 A, high Icw for selective circuit-breakers and, for the current-limiting version, an incredible Icu of 150kA at 415V AC. Performances proven by reliability, safety and ABB SACE's high quality standards.


ABB
SACE X1
268 mm
210 mm
129 mm

New X1 by Emax.
Small is better.

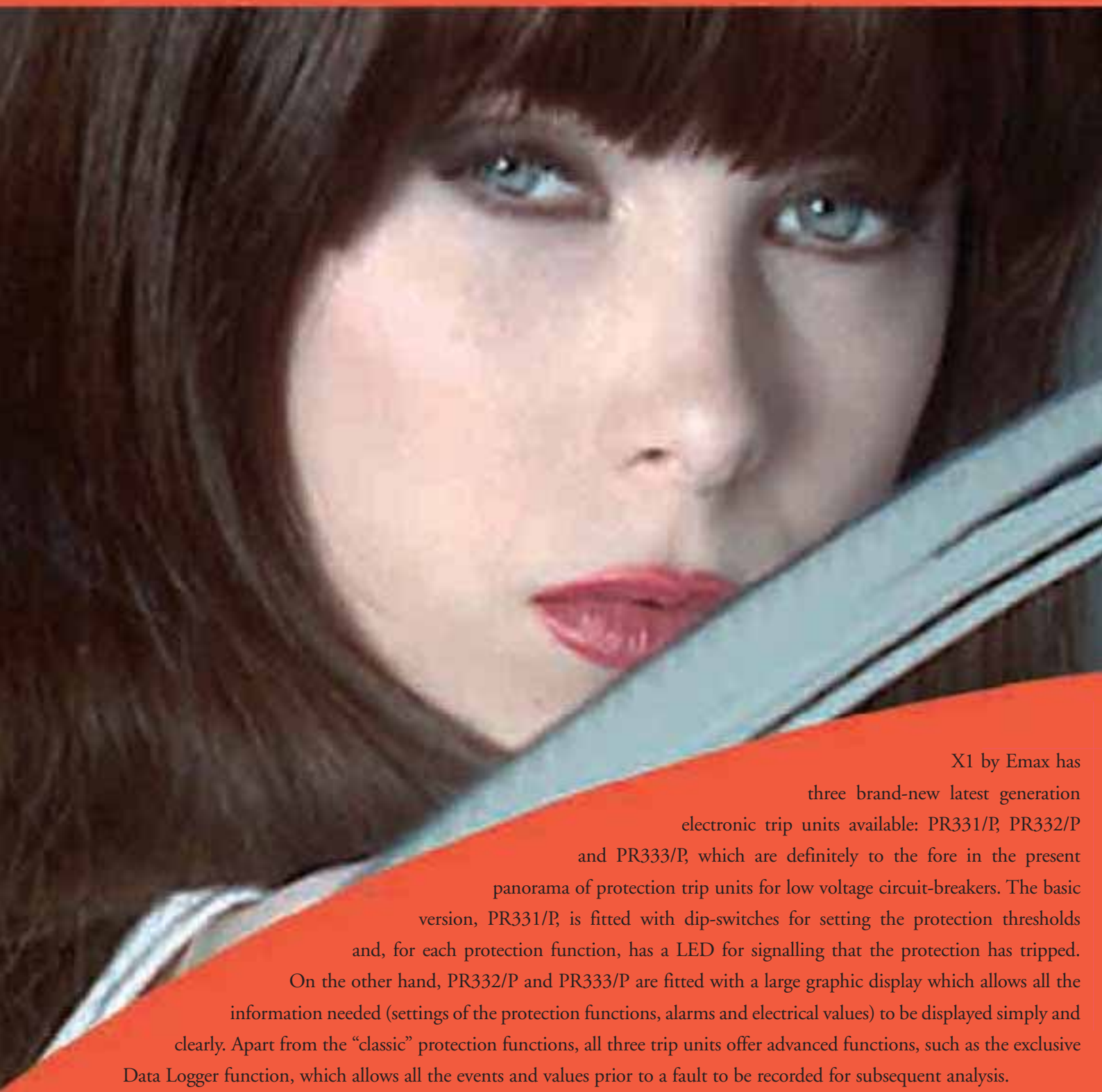


The decidedly compact dimensions offer enormous benefits in terms of easier installation and wiring cabling – the space for curving the wires cables or for busbar passage definitely becomes greater. Furthermore, the smaller dimensions allow optimisation of installations, making them decidedly slimmer, also thanks to new and extremely effective installation solutions.

For the first time, an air circuit-breaker can be installed on a back plate and in a horizontal position, both in the fixed and withdrawable version. Moreover, with the new racking-in system of the moving part, its operation becomes even safer because it prevents accidental or unwarranted and potentially hazardous operations.


ABB
SACE X1
ABB
SACE X1

New X1 by Emax.
Small and intelligent.



X1 by Emax has three brand-new latest generation electronic trip units available: PR331/P, PR332/P and PR333/P, which are definitely to the fore in the present panorama of protection trip units for low voltage circuit-breakers. The basic version, PR331/P, is fitted with dip-switches for setting the protection thresholds and, for each protection function, has a LED for signalling that the protection has tripped. On the other hand, PR332/P and PR333/P are fitted with a large graphic display which allows all the information needed (settings of the protection functions, alarms and electrical values) to be displayed simply and clearly. Apart from the "classic" protection functions, all three trip units offer advanced functions, such as the exclusive Data Logger function, which allows all the events and values prior to a fault to be recorded for subsequent analysis.


L
S
I
G


by
SACE PR332/P
COM
Power
TX
RX
In=1600A
ABB
SACE X1

Main characteristics and ranges

1

Contents

Overview of the Emax family

Fields of application **1**/2

Emax X1 air circuit-breakers

The Ranges **1**/4

Construction characteristics

Structure of the circuit-breaker **1**/6

Operating mechanism **1**/7

Operating and signalling parts **1**/8

Fixed parts of withdrawable circuit-breakers **1**/9

Utilization category **1**/10

Versions and connections **1**/11

Electronic trip units

General characteristics **1**/12

Versions available **1**/14

Rating plugs **1**/15

Compliance with Standards

Standards, approvals and certifications **1**/16

A design dedicated to Quality and respect for the environment **1**/17

Overview of the Emax family

Fields of application

			X1			E1		E2				
Automatic circuit-breakers			**X1B**	**X1N**	**X1L**	**E1B**	**E1N**	**E2B**	**E2N**	**E2S**	**E2L**	
Poles		[No.]		3-4			3 - 4			3 - 4		
4p CB neutral current-carrying capacity		[% Iu]		100			100			100		
Iu	(40 °C)	[A]	630-800-1000-1250-1600	630-800-1000-1250-1600	630-800-1000-1250-	800-1000-1250-1600	800-1000-1250-1600	1600-2000	1000-1250-1600-2000	800-1000-1250-1600-2000	1250-1600	
Ue		[V~]	690	690	690	690	690	690	690	690	690	
Icu	(220...415V)	[kA]	42	65	150	42	50	42	65	85	130	
Ics	(220...415V)	[kA]	42	50	150	42	50	42	65	85	130	
Icw	(1s)	[kA]	42	42	15	42	50	42	55	65	10	
	(3s)	[kA]				36	36	42	42	42	–	
Automatic circuit-breakers with full-size neutral conductor												
Poles		[No.]	Standard version			Standard version		Standard version				
4p CB neutral current-carrying capacity		[% Iu]										
Iu	(40 °C)	[A]										
Ue		[V~]										
Icu	(220...415V)	[kA]										
Ics	(220...415V)	[kA]										
Icw	(1s)	[kA]										
	(3s)	[kA]										
Switch-disconnectors			**X1B/MS**			**E1B/MS**	**E1N/MS**	**E2B/MS**	**E2N/MS**	**E2S/MS**		
Poles		[No.]	3-4			3 - 4	3 - 4	3 - 4	3 - 4	3 - 4		
Iu	(40 °C)	[A]	1000-1250 1600			800-1000-1250-1600	800-1000-1250-1600	1600-2000	1000-1250-1600-2000	1000-1250-1600-2000		
Ue		[V~]	690			690	690	690	690	690		
Icw	(1s)	[kA]	42			42	50	42	55	65		
	(3s)	[kA]				36	36	42	42	42		
Icm	(220...440V)	[kA]	88.2			88,2	105	88,2	121	143		
Automatic circuit-breakers for applications up to 1150 V AC *			**X1B/E**					**E2B/E**	**E2N/E**			
Poles		[No.]	3-4					3 - 4	3 - 4			
Iu	(40 °C)	[A]	630-800-1000-1250-1600					1600-2000	1250-1600-2000			
Ue		[V~]	1000					1150	1150			
Icu	(1150V)	[kA]	20					20	30			
Ics	(1150V)	[kA]	20					20	30			
Icw	(1s)	[kA]	20					20	30			
Switch-disconnectors for applications up to 1150 V AC *			**X1B/E MS**					**E2B/E MS**	**E2N/E MS**			
Poles		[No.]	3-4					3 - 4	3 - 4			
Iu	(40 °C)	[A]	1000-1250-1600					1600-2000	1250-1600-2000			
Ue		[V~]	1000					1150	1150			
Icw	(1s)	[kA]	20					20	30			
Icm	(1000V)	[kA]	40					40	63			
Switch-disconnectors for applications up to 1000 V DC						**E1B/E MS**		**E2N/E MS**				
Poles		[No.]				3 - 4		3 - 4				
Iu	(40 °C)	[A]				800-1250		1250-1600-2000				
Ue		[V-]				750 (3p)-1000(4p)		750 (3p)-1000(4p)				
Icw	(1s)	[kA]				20		25				
Icm	(750V)	[kA]				42		52,5				
	(1000V)	[kA]				42		52,5				
Sectionalizing truck						**E1 CS**		**E2 CS**				
Iu	(40 °C)	[A]				1250		2000				
Earthing switch with making capacity						**E1 MTP**		**E2 MTP**				
Iu	(40 °C)	[A]				1250		2000				
Earthing truck						**E1 MT**		**E2 MT**				
Iu	(40 °C)	[A]				1250		2000				

(*) 1000V for Emax X1.

	E3					E4			E6	
	E3N	**E3S**	**E3H**	**E3V**	**E3L**	**E4S**	**E4H**	**E4V**	**E6H**	**E6V**
			3 - 4				3 - 4		3 - 4	
			100				50		50	
	2500-3200	1000-1250-1600-2000-2500-3200	800-1000-1250-1600-2000-2500-3200	800-1250-1600-2000-2500-3200	2000-2500	4000	3200-4000	3200-4000	4000-5000-6300	3200-4000-5000-6300
	690	690	690	690	690	690	690	690	690	690
	65	75	100	130	130	75	100	150	100	150
	65	75	85	100	130	75	100	150	100	125
	65	75	75	85	15	75	100	100	100	100
	65	65	65	65	–	75	75	75	85	85

						E4S/f	**E4H/f**		**E6H/f**	
			Standard version			4	4		4	
						100	100		100	
						4000	3200-4000		4000-5000-6300	
						690	690		690	
						80	100		100	
						80	100		100	
						80	85		100	
						75	75		100	

	E3N/MS	**E3S/MS**	**E3V/MS**	**E4S/MS**	**E4H/MS**	**E4H/f MS**	**E6H/MS**	**E6H/f MS**
	3 - 4	3 - 4	3-4	3 - 4	3 - 4	4	3-4	4
	2500-3200	1000-1250-1600-2000-2500-3200	800-1250-1600-2000-2500-3200	4000	3200-4000	3200-4000	4000-5000-6300	4000-5000-6300
	690	690	690	690	690	690	690	690
	65	75	85	75	100	85	100	100
	65	65	65	75	75	75	85	85
	143	165	286	165	220	220	220	220

	E3H/E	**E4H/E**	**E6H/E**
	3 - 4	3 - 4	3 - 4
	1250-1600-2000-2500-3200	3200-4000	4000-5000 6300
	1150	1150	1150
	30 (*)	65	65
	30 (*)	65	65
	30 (*)	65	65

	E3H/E MS	**E4H/E MS**	**E6H/E MS**
	3 - 4	3 - 4	3 - 4
	1250-1600-2000-2500-3200	3200-4000	4000-5000 6300
	1150	1150	1150
	50	65	65
	105	143	143

	E3H/E MS	**E4H/E MS**	**E6H/E MS**
	3 - 4	3 - 4	3 - 4
	1250-1600-2000-2500-3200	3200-4000	4000-5000-6300
	750 (3p)-1000(4p)	750 (3p) - 1000 (4p)	750 (3p) - 1000 (4p)
	40	65	65
	105	143	143
	105	143	143

	E3 CS	**E4 CS**	**E6 CS**
	3200	4000	6300

	E3 MTP	**E4 MTP**	**E6 MTP**
	3200	4000	6300

	E3 MT	**E4 MT**	**E6 MT**
	3200	4000	6300

Emax X1 air circuit-breakers

The Ranges

1

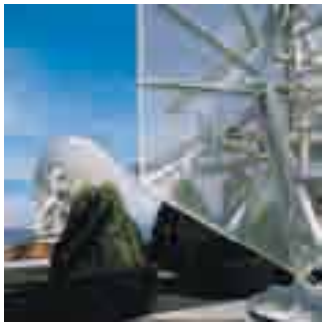
Common data		
Voltages		
Rated service voltage **Ue**	[V]	690 ~
Rated insulation voltage **Ui**	[V]	1000
Rated impulse withstand voltage **Uimp**	[kV]	12
Operating temperature	[°C]	-25....+70
Storage temperature	[°C]	-40....+70
Frequency f	[Hz]	50 - 60
Number of poles		3 - 4
Versions		Fixed - Withdrawable

Emax X1 automatic circuit-breakers			X1		
Performance levels			B	N	L
Currents: rated uninterrupted current (at 40 °C) Iu		[A]	**630**	**630**	**630**
		[A]	**800**	**800**	**800**
		[A]	**1000**	**1000**	**1000**
		[A]	**1250**	**1250**	**1250**
		[A]	**1600**	**1600**	
		[A]			
Neutral pole current-carrying capacity for 4-pole CBs		[%Iu]	100	100	100
Rated ultimate breaking capacity under short-circuit **Icu**					
220/230/380/400/415 V ~		[kA]	42	65	150
440 V ~		[kA]	42	65	130
500/525 V ~		[kA]	42	50	100
660/690 V ~		[kA]	42	50	60
Rated service breaking capacity under short-circuit **Ics**					
220/230/380/400/415 V ~		[kA]	42	50	150
440 V ~		[kA]	42	50	130
500/525 V ~		[kA]	42	50	100
660/690 V ~		[kA]	42	50	60
Rated short-time withstand current **Icw**	(1s)	[kA]	42	42	15
Rated making capacity under short-circuit (peak value) **Icm**					
220/230/380/400/415 V ~		[kA]	88.2	143	330
440 V ~		[kA]	88.2	143	286
500/525 V ~		[kA]	88.2	105	220
660/690 V ~		[kA]	88.2	105	132
Utilisation category (according to CEI EN 60947-2)			B	B	A
Isolation behaviour (according to CEI EN 60947-2)			■	■	■
Overcurrent protection					
Electronic trip units for AC applications			■	■	■
Operating times					
Closing time (max)		[ms]	80	80	80
Breaking time for I<Icw (max) (1)		[ms]	70	70	70
Breaking time for I>Icw (max)		[ms]	30	30	12
Overall dimensions					
Fixed: H = 268 mm - D = 181 mm - W (3/4 poles)		[mm]		210/280	
Withdrawable: H = 343 mm - D = 254 mm - W (3/4 poles)		[mm]		284/354	
Weights (circuit-breaker complete with releases and CS, excluding accessories)					
Fixed 3/4 poles		[kg]		11/14	
Withdrawable 3/4 poles (including fixed part)		[kg]		32/42.6	

(1) Without intentional delays.

			X1		
Rated uninterrupted current (at 40 °C) Iu		[A]	630-800	1000-1250	1600
Mechanical life with regular ordinary maintenance		[No. operations x 1000]	12,5	12,5	12,5
Operation frequency		[Operations/hour]	60	60	60
Electrical life	(440 V ~)	[No. operations x 1000]	6	4	3
	(690 V ~)	[No. operations x 1000]	3	2	1
Operation frequency		[Operations/hour]	30	30	30

Emax X1 switch-disconnectors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The Emax X1 switch-disconnectors are derived from the corresponding circuit-breakers, of which they maintain the overall dimensions and the possibility of mounting accessories.
This version only differs from the circuit-breakers in the absence of overcurrent releases. The circuit-breaker is available in both fixed and withdrawable, three-pole and four-pole versions. The switch-disconnectors, identified by the letters "/MS", can be used according to category of use AC-23A (switching motor loads or other highly inductive loads) in accordance with the IEC 60947-3 Standard.
The electrical specifications of the switch-disconnectors are listed in the table below.

			X1B/MS
Rated uninterrupted current (at 40 °C) Iu		[A]	**1000 - 1250 - 1600**
Rated service voltage **Ue**		[V ~]	690
		[V –]	250
Rated insulation voltage **Ui**		[V ~]	1000
Rated impulse withstand voltage **Uimp**		[kV]	12
Rated short-time withstand current **Icw**	(1s)	[kA]	42
Rated making capacity under short-circuit (peak value) **Icm**			
220/230/380/400/415/440 V ~		[kA]	88.2
500/660/690 V ~		[kA]	88.2

Note: the breaking capacity Icu, by means of external protection relay, with 500ms maximum timing, is equal to the value of Icw (1s).

Emax X1 automatic circuit-breakers for applications up to 1000V AC


1SDC200060F0001

Emax X1B can be supplied in a special version for rated service voltages up to 1000 V in AC. Circuit-breaker in this version is identified by the letter of the standard range (rated service voltage up to 690 V AC) plus "/E", and is derived from the corresponding standard Emax X1B. It offers the same versions and accessories as the latter. The Emax X1B can be either fixed and withdrawable, in both three-pole and four-pole versions. Emax X1/E circuit-breaker is especially suitable for installation in mines, oil and chemical plants, and for traction.
The table below shows the electrical specifications of the range.

			X1B/E
Rated uninterrupted current (at 40 °C) Iu		[A]	**630 - 800 - 1000 - 1250 - 1600**
Rated service voltage **Ue**		[V ~]	1000
Rated insulation voltage **Ui**		[V ~]	1000
Rated ultimate breaking capacity under short-circuit **Icu**	1000 V ~	[kA]	20
Rated service breaking capacity under short-circuit **Ics**	1000 V ~	[kA]	20
Rated short-time withstand current **Icw**	(1s)	[kA]	20

Emax X1 switch-disconnectors for applications up to 1000V AC


1SDC200061F0001

The switch-disconnectors of Emax X1 family complete the range of apparatus for applications at 1000V in alternating current (AC). It conforms with the IEC 60947-3 Standards.
Circuit-breaker in this version is identified by the letter of the standard range, where the rated service voltage is up to 690 V AC, plus "/E", thus becoming Emax X1B/E MS. It is derived from the corresponding standard switch-disconnector X1B/MS.
It is available in the three-pole and four-pole, fixed and withdrawable versions, with accessory options and installations as for the corresponding standard circuit-breaker.

			X1B/E MS
Rated uninterrupted current (at 40 °C) Iu		[A]	**1000 - 1250 - 1600**
Poles			3 - 4
Rated service voltage **Ue**		[V ~]	1000
Rated insulation voltage **Ui**		[V ~]	1000
Rated impulse withstand voltage **Uimp**		[kV]	12
Rated short-time withstand current **Icw**	(1s)	[kA]	20
Rated making capacity under short-circuit (peak value)		[kA]	40

Construction characteristics

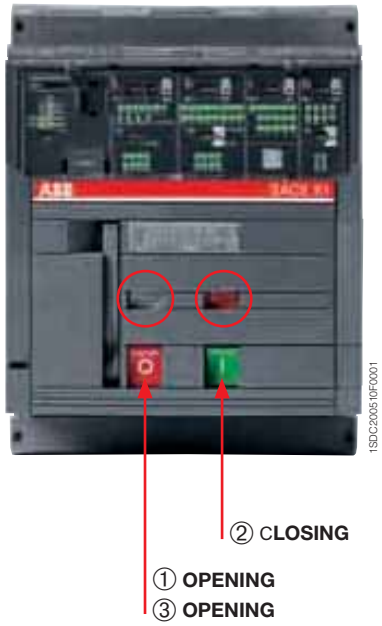
Structure of the circuit-breaker

The structure of the Emax X1 air circuit-breaker is extremely compact, considerably reducing overall dimensions. Furthermore, another very important characteristic of X1 is the possibility of installing it both in vertical or lying down position. Thus, it's possible to reduce in a consistent manner the switchgear dimensions. For example, thanks to a very low width, the number of the circuit-breakers in the switchgear's column can be increased by making a lying installation.

Construction characteristics

Operating mechanism

The operating mechanism is of the stored energy type, operated using pre-charged springs.
The springs are charged manually by operating the front lever or using a geared motor, supplied on request.
The opening springs are charged automatically during the closing operation.
With the operating mechanism fitted with shunt closing and opening releases and the geared motor for charging the springs, the circuit-breaker can be operated by remote control and, if required, co-ordinated by a supervision and control system.



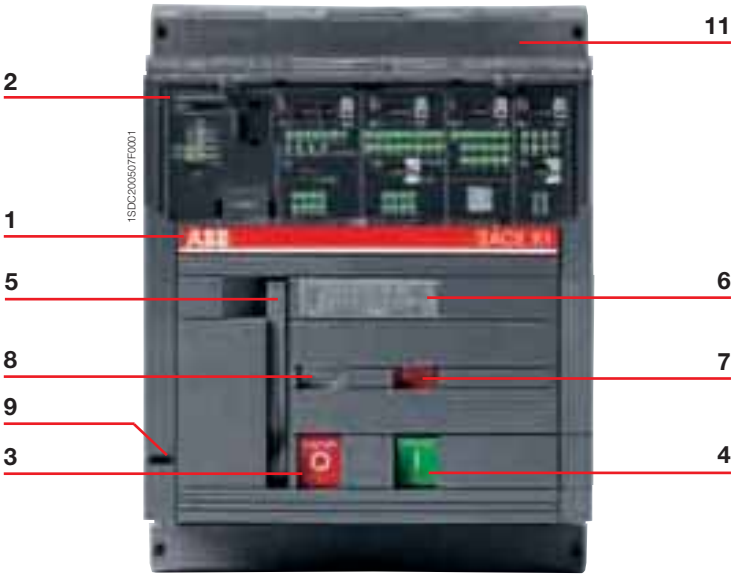
The following operating cycles are possible without recharging the springs:
– starting with the circuit-breaker open (0) and the springs charged:
  closing-opening
– starting with the circuit-breaker closed (I) and the springs charged:
  opening-closing-opening.

The operating mechanism is fitted with a mechanical and electrical anti-pumping device.

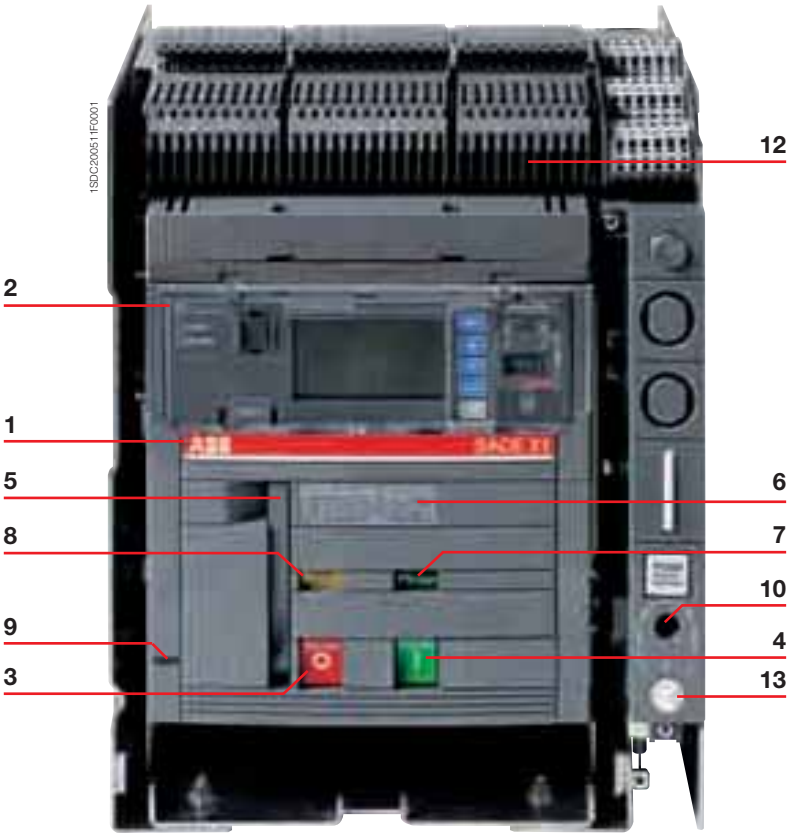
Construction characteristics

Operating and signalling parts

Fixed version



Withdrawable version



Caption	
1	Trademark and size of circuit-breaker
2	PR331/P, PR332/P or PR333/P trip units
3	Pushbutton for manual opening
4	Pushbutton for manual closing
5	Lever to manually charge closing springs
6	Electrical rating plate
7	Mechanical device to signal circuit-breaker open “O” and closed “I”
8	Signal for springs charged or discharged
9	Mechanical signalling of overcurrent releases tripped (TRIP RESET)
10	Racking-in/out device (for withdrawable version only)
11	Terminal box (for fixed version only)
12	MP sliding contacts (for withdrawable version only)
13	Circuit-breaker position indicator: racked-in/ test isolated /racked-out / connected/test isolated/disconnected (for withdrawable version only)

Note:
“Racked-in” refers to the position in which both the power contacts and auxiliary contacts are connected; “racked-out” is the position in which both the power contacts and auxiliary contacts are disconnected; “test isolated” is the position in which the power contacts are disconnected, whereas the auxiliary contacts are connected.

Construction characteristics

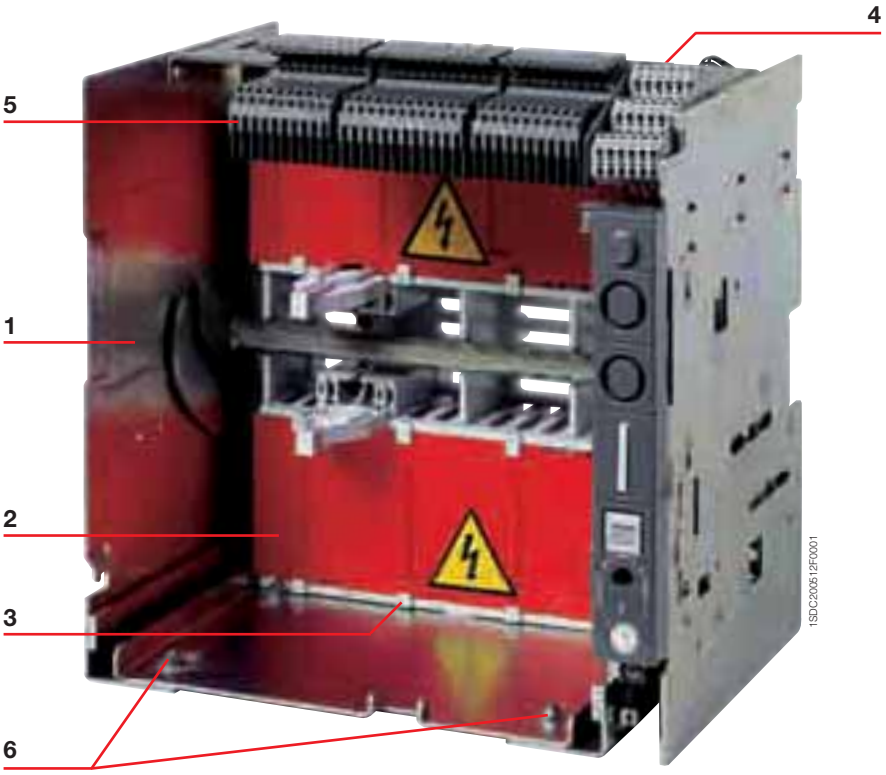
Fixed parts of withdrawable circuit-breakers

The fixed parts of withdrawable circuit-breakers have shutters for segregating the fixed contacts when the circuit-breaker is withdrawn from the compartment. These can be locked in their closed position using padlock devices.

Caption

1	Sheet steel supporting structure
2	Safety shutters (protection rating IP20)
3	Terminal support base
4	Terminals (rear, front)
5	FP sliding contacts
6	Fastening points*

* To fix the fixed part on the back plate, use the four rear holes



Construction characteristics

Utilization category

Selective and current-limiting circuit-breakers

Selective (not current-limiting) **circuit-breakers** are classified in class B (according to the IEC 60947-2 Standard). It is important to know their Icw values in relation to any possible delayed trips in the event of short-circuits.

The **current-limiting circuit-breaker** X1L belongs to class A. The short-time withstand current Icw is not very important for this circuit-breaker, and is necessarily low due to the operating principle on which it is based. The fact that it belongs to class A does not preclude the possibility of obtaining the necessary selectivity (e.g. current-type or time-type selectivity).
The special advantages of current-limiting circuit-breakers should also be underlined. In fact, they make it possible to:

– significantly reduce the peak current in relation to the prospective value;
– drastically limit specific let-through energy.

The resulting benefits include:

– reduced electrodynamic stresses;
– reduced thermal stresses;
– savings on the sizing of cables and busbars;
– the possibility of coordinating with other circuit-breakers in the series for back-up or discrimination.

Versions and connections

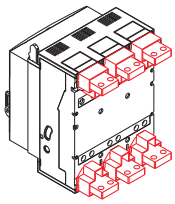
All the circuit-breakers of the Emax X1 range are available in fixed and withdrawable, three-pole or four-pole versions.
Each version offers terminals made of silverplated copper bars, with the same dimensions, regardless of the rated currents of the circuit-breakers.
The availability of various types of interchangeable terminals makes it possible to build wall-mounted switchgear, or switchgear to be accessed from behind with rear connections.
Furthermore, new horizontal rear terminals give Emax X1 maximum flexibility, allowing horizontal terminals to be changed to vertical ones and vice versa.

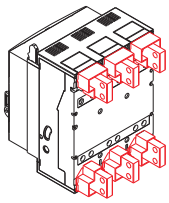
For fixed version, the following terminals are available:
– rear terminals (horizontal, vertical and adjustable)*
– front terminals
– extended front terminals
– spreaded front terminals
– multicable terminals for FC CuAl 4x240 mm^2
– multicable terminals for FC CuAl 2x240 mm^2

For withdrawable version:
– rear terminals (horizontal/vertical)*
– front extended terminals
– spreaded rear terminals
– spreaded front terminals

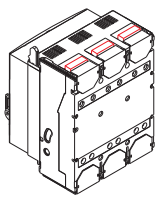
* It is possible to realise a varied combination of terminals (upper terminals different from the lower ones)

Fixed circuit-breaker

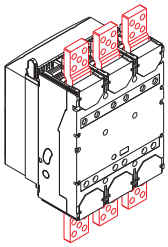




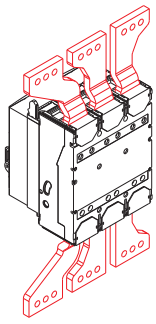
Rear terminals (horizontal, vertical or adjustable)



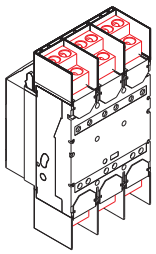
Front terminals



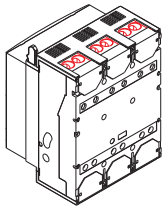
Front extended terminals



Spreaded front terminals

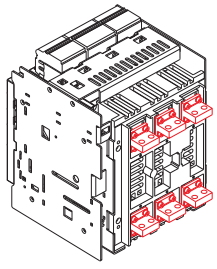


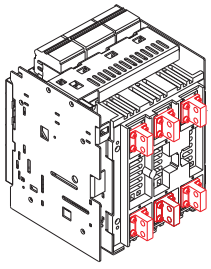
Multicable terminals for FC CuAl 4x240 mm^2



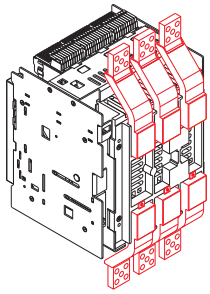
Multicable terminals for FC CuAl 2x240 mm^2

Withdrawable circuit-breaker

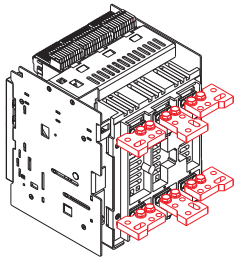




Adjustable rear terminals (horizontal or vertical)



Front extended terminals



Spreaded rear terminals

Electronic trip units

General characteristics

The overcurrent protection for AC installations uses three types of electronic trip unit series: PR331/P, PR332/P and PR333/P.
The basic series, PR331/P, offers the whole set of standard protection functions, complete with a user-friendly interface. It allows discrimination of which fault caused the trip by means of the new led indications.
PR332/P and PR333/P trip units are of new concept modular architecture. It is now possible to have a complete series of protections, accurate measurements, signalling or dialogue functions, designed and customisable for all application requirements.
The protection system is made up of:

- 3 or 4 new generation current sensors (Rogowsky coil);
- external current sensors (i.e. for external neutral, residual current or source ground return protection);
- a protection unit selected among PR331/P, PR332/P or PR333/P with optional communication module via Modbus or Fieldbus plug network (PR332/P and PR333/P only), as well as via a wireless connection;
- a trip coil, which acts directly on the circuit-breaker operating mechanism (supplied with the protection unit).

General specifications of the electronic trip units include:
- operation without the need for an external power supply
- microprocessor technology
- high precision
- sensitivity to the true R.M.S. value of the current
- trip cause indication and trip data recording
- interchangeability among all types of releases
- setting for neutral configurable:
  – OFF-50%-100%-200% of phase setting

The main performance features of the electronic trip units are listed below.

PR331/P

Protection	PR331/P	PR331/P	PR331/P
	L I MCR*	L S I MCR*	L S I G MCR*

* optional

PR332/P

Protection	PR332/P	PR332/P	PR332/P	PR332/P
	L I MCR*	L S I MCR*	L S I G MCR*	L S I Rc MCR*

For all versions: U OT M

Modules available:

PR330/V - Measuring	opz.	UV OV RV RP UF OF
PR330/D-M and PR330/R - Communication and implementation	opt.	

* optional

PR333/P

Protection	PR333/P	PR333/P
	L S I MCR*	L S I G MCR*

For all versions: OT D U UV OV RV RP M UF OF

Modules available:

PR330/D-M and PR330/R - Communication and implementation	opt.	

* optional

Electronic trip units

Versions available

1

Features

Protection functions		PR331/P	PR332/P	PR333/P
L	Protection against overload with inverse long time-delay trip	■	■	■
S	Selective protection against short-circuit inverse or definite short time-delay trip	■	■	■
S	Second selective protection against short-circuit inverse or definite short time-delay trip			■
I	Protection against instantaneous short-circuit with adjustable trip current threshold	■	■	■
G	Protection against earth fault — residual	■	■	■
	Protection against earth fault — source ground return		■	■
Rc	Residual current protection (1)		■	opt.(2)
MCR	Protection against closing under short-circuit	with AUX - MCR	with AUX - MCR	with AUX - MCR
D	Protection against directional short-circuit with adjustable time-delay			■
U	Protection against phase unbalance		■	■
OT	Protection against overtemperature (check)		■	■
UV	Protection against undervoltage		with PR330/V	■
OV	Protection against overvoltage		with PR330/V	■
RV	Protection against residual voltage		with PR330/V	■
RP	Protection against reverse active power		with PR330/V	■
M	Thermal memory for functions L and S	■	■	■
UF	Underfrequency		with PR330/V	■
OF	Overfrequency		with PR330/V	■
Measurements				
Currents (phases, neutral, earth fault)			■	■
Voltage (phase-phase, phase-neutral, residual)			with PR330/V	■
Power (active, reactive, apparent)			with PR330/V	■
Power factor			with PR330/V	■
Frequency and peak factor			with PR330/V	■
Energy (active, reactive, apparent, meter)			with PR330/V	■
Harmonics calculation (display of wave forms and harmonics module)				■
Event marking and maintenance data				
Event marking with time stamp		opt.(3)	■	■
Chronological event storage		opt.(3)	■	■
Counting the number of operations and contact wear			■	■
Communication with supervision system and centralised control				
Remote parameter setting of the protection functions, unit configuration, communication			with PR330/D-M	with PR330/D-M
Transmission of measurements, states and alarms from circuit-breaker to system			with PR330/D-M	with PR330/D-M
Transmission of the events and maintenance data from circuit-breaker to system			with PR330/D-M	with PR330/D-M
Watchdog				
Alarm and trip for release overtemperature			■	■
Check of the release status		■	■	■
Interface with the user				
Presetting parameters by means of dip switches		■		
Presetting parameters by means of keys and LCD viewer			■	■
Alarm signals for functions L, S, I and G		■	■	■
Alarm signal of all the following protections: undervoltage, overvoltage, residual voltage, active reverse of power, phase unbalance, overtemperature, inversion of cyclical sense of the phases			with PR330/V	■
Complete management of pre-alarms and alarms for all the self-control protection functions			■	■
Enabling password for use with consultation in “READ” mode or consultation and setting in “EDIT” mode		■	■	
Correct control of phase cycle				■
Load control				
Load connection and disconnection according to the current passing through the circuit-breaker			■	■
Zone selectivity				
Can be activated for protection functions S, G and (PR333/P only) D			■	■

(1) requires a homopolar toroid for residual current protection; (2) with residual current toroidal transformer, PR333/P LSIG and rating plug Rc; (3) with communication unit BT030 or PR010T

Electronic trip units

Rating plugs

Rating plugs

Type of circuit-breaker	Rated current I_u	In [A] 400	630	800	1000	1250	1600
X1B	630	■	■				
	800	■	■	■			
	1000	■	■	■	■		
	1250	■	■	■	■	■	
	1600	■	■	■	■	■	■
X1N	630	■	■				
	800	■	■	■			
	1000	■	■	■	■		
	1250	■	■	■	■	■	
	1600	■	■	■	■	■	■
X1L	630	■	■				
	800	■	■	■			
	1000	■	■	■	■		
	1250	■	■	■	■	■	

Compliance with Standards

Standards, approvals and certifications

Emax X1 and their accessories conform to the international IEC 60947, EN 60947 (harmonized in 28 CENELEC countries), CEI EN 60947 and IEC 61000 Standards, and comply with following EC directives:

– "Low Voltage Directives" (LVD) no. 2006/95/CE (replaces 72/23/ EEC and subsequent amendments).
– "Electromagnetic Compatibility Directive" (EMC) nr. 89/336 EEC.

The following Shipping Registers certifications are being approved:

– RINA (Italian Naval Register)
– Det Norske Veritas
– Bureau Veritas
– Germanischer Lloyd
– Loyd's Register of Shipping
– Polskj Rejestr Statkow
– ABS (American Bureau of Shipping)
– RMRS (Russian Maritime Register of Shipping)
– NK (Nippon Kaiji Kyokai)

The Emax X1 has also a range which is under certification according to the severe American UL 1066 and UL 489 Standards, the Russian GOST (Russia Certificate of Conformity) certification organization, and CCC (China Compulsory Certification).

Certification of conformity with the aforementioned product Standards is carried out in compliance with European Standard EN 45011 by the Italian certification body ACAE (Associazione per la Certificazione delle Apparecchiature Elettriche - Association for Certification of Electrical Apparatus), recognized by the European organization LOVAG (Low Voltage Agreement Group).

Note: Contact ABB SACE for a list of approved types of circuit-breakers, approved performance data and the corresponding validity

Compliance with Standards

A design dedicated to Quality and respect for the environment

Quality, environment, health and safety have always been ABB SACE's major commitment. This commitment involves every function of the company, and has allowed us to achieve prestigious recognition internationally.
The company's quality management system is certified by RINA, one of the most prestigious international certification boards, and complies with ISO 9001-2000 Standards; the ABB SACE test facility is accredited by SINAL; the plants in Frosinone, Patrica, Vittuone and Garbagnate Monastero are also certified in compliance with ISO 14001 and OHSAS 18001 standards for health and safety in the workplace.

ABB SACE, Italy's first industrial company in the electro-mechanical sector to achieve this, has been able to reduce its raw material consumption and machining scrap by 20% thanks to an ecology-centred revision of its manufacturing process. All of the company's Divisions are involved in streamlining raw material and energy consumption, preventing pollution, limiting noise pollution and reducing scrap resulting from manufacturing processes, as well as in carrying out periodic environmental audits of leading suppliers.

ABB SACE is committed to environmental protection, as is also evidenced by the Life Cycle Assessments (LCA) of products carried out at the Research Centre: this means that assessments and improvements of the environmental performance of products throughout their lifecycle are included right from the initial engineering stage. The materials, processes and packaging used are chosen with a view to optimising the actual environmental impact of each product, including its energy efficiency and recyclability.

X1 by EmaX

Installations

Contents

Installation in switchgear

Extremely reduced volumes **2**/2

Choosing the type of circuit-breaker **2**/3

Current-carrying capacity in switchgear **2**/6

Changing the rated uninterrupted current in relation to the temperature

Temperature derating **2**/7

Derating at different altitudes **2**/9

Current-limiting and specific let-through energy curves for X1L limiting circuit-breakers **2**/10

Installation in switchgear

Extremely reduced volumes

The Emax X1 circuit-breakers have been built according to modular design criteria for easier installation and integration in low voltage electrical switchgear, thanks to a significant reduction in their overall installation dimensions, particularly in width and depth.
This allows the realization of switchgear dimensions particularly reduced, characteristic which makes the Emax X1 especially suitable where spaces saving is needed: for example in applications as on boards of ships, in mines, on drilling platforms and windmill turbine.
Emax circuit-breakers are suitable for Power Center switchgear and make it easy to comply with the segregation requirements of the IEC 60439-1 Standards.

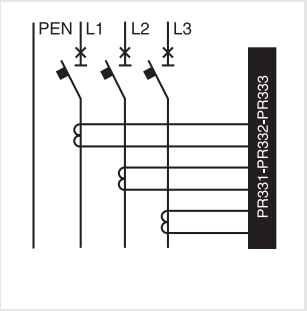
Installation in switchgear

Choosing the type of circuit-breaker

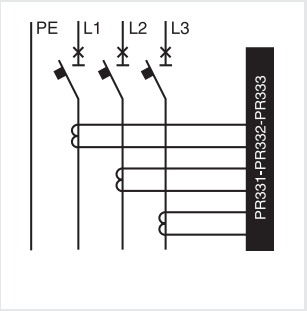
Number of poles

The choice of the number of poles for circuit-breakers that simultaneously provide switching, protection and isolation functions in three-phase installations depends on the type of electrical system (TT, TN-S, TN-C, IT) and the type of user or, more generally, whether it features a distributed or non-distributed neutral.

Three-pole circuit-breakers

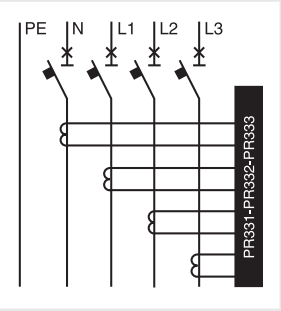


For TN-C systems (the neutral cannot be interrupted because it also acts as the protection conductor).



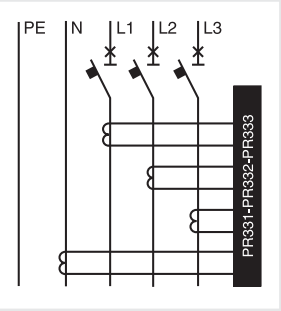
For users that do not use the neutral (e.g.: asynchronous motors) and, for systems with undistributed neutral in general.

Four-pole circuit-breakers



In all other instances, with exceptions for the IT system (see CEI 64-8/473.3.2.2 Standards).

Three-pole circuit-breakers with external neutral



Current transformers can be installed on the external neutral of five-wire systems (TN-S) with 3-pole circuit-breakers.

Fixed or withdrawable version

The fixed version of the circuit-breaker is more compact in size than the withdrawable version. It is recommended for installations that can tolerate service interruptions in the event of faults or programmed maintenance.

The withdrawable version of the circuit-breaker is recommended for:

– applications that can only tolerate brief interruptions due to faults or programmed maintenance;

– dual lines, one of which is a standby for the other, with a single circuit-breaker for each pair.

The moving part of a circuit-breaker in withdrawable version may be in three position inside the fixed part: racked-in, test isolated and racked-out.

“Racked-in” refers to the position in which both the power contacts and auxiliary contacts are connected; “racked-out” is the position in which both the power contacts and auxiliary contacts are disconnected; “test isolated” is the position in which the power contacts are disconnected, whereas the auxiliary contacts are connected.

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Installation in switchgear

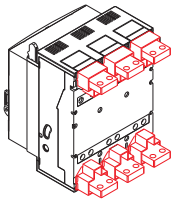
Choosing the type of circuit-breaker

Connecting the main circuit-breaker circuits

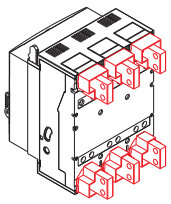
When designing switchgear, it is always necessary to find the most rational connections between the circuit-breaker and main busbar system and from the busbars to the users. Emax X1 offers switchgear manufacturers a range of options to satisfy different circuit-breaker connection requirements.
The circuit-breakers can be fitted with various combinations of top and bottom terminals.
The figures below give some indications for terminal selection.

Switchgear with access from the rear:

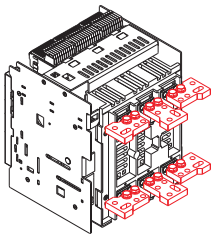
Horizontal rear terminals



Vertical rear terminals

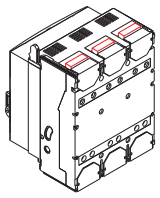


Spreaded rear terminals

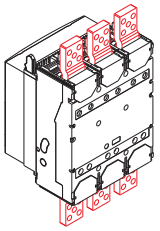


Wall-mounted switchgear, with access from the front only:

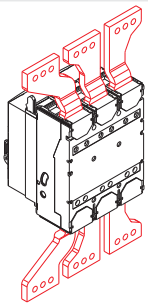
Front terminals



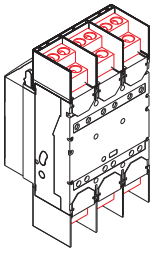
Extended front terminals



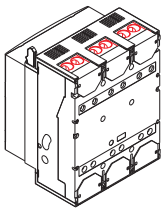
Spreaded front terminals



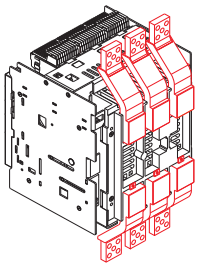
Multicable terminals for FC CuAl - 4x240 mm²



Multicable terminals for FC CuAl - 2x240 mm²



Extended front terminals - EF



Installation

The new Emax X1, in the fixed and withdrawable versions, can be installed on a back plate both in the vertical and horizontal position, without jeopardising the rated characteristics of the circuit-breaker. In the vertical position, the circuit-breaker can also be installed flat, fixing it by means of shoulders provided as standard.
In compliance with the IEC 60947-2 Standards, Emax circuit-breakers can also be supplied through either top or bottom terminals, without jeopardizing the apparatus functionality.
Those characteristics allow maximum flexibility of use and make it easier the installation in switchgear.

Protection Degrees

A number of solutions have been adopted on Emax circuit-breakers to achieve IP20 degree of protection for fixed or withdrawable circuit-breakers, excluding the terminals, and IP30 for their front parts using a flange. Automatic shutters have been designed for the fixed parts of withdrawable circuit-breakers which can be locked using padlock devices to allow maintenance on the load side or on the power-supply side of the fixed part.
A transparent protective cover is also available on request, to completely segregate the front of the circuit-breaker, reaching IP54 degree of protection. In any case, the front panel and protection trip unit with the relative indications remain completely visible.

IP20 Fixed or withdrawable version circuit-breaker, excluding the terminals.
IP30 Front parts of the circuit-breakers (using a flange).
IP54 Fixed or withdrawable version circuit-breaker, fitted with transparent protective cover to be fixed onto the front of the switchgear (on request).

Installation in switchgear

Current-carrying capacity in switchgear

Power losses

The IEC 439-1 and CEI EN 60439-1 Standards prescribe calculations for determining the heat dissipation of ANS type switchgear (non-standard), for which the following must be taken into consideration:

– the overall dimensions
– the rated current of the busbars and connections and the relative dissipation
– the dissipated power of the apparatus mounted in the switchgear.

For this point, the table beside provides information on the circuit-breakers. For other apparatus, please consult the catalogues of the relative manufacturers.

Power losses

Circuit-breaker	Iu [A]	Fixed 3/4 Poles [W]	Withdrawable 3/4 Poles [W]
X1 B-N	630	31	60
	800	51	104
	1000	79	162
	1250	124	253
	1600	203	415
X1 L	630	61	90
	800	99	145
	1000	155	227
	1250	242	354

Note
The table values refer to balanced loads, a current flow of Iu, and automatic circuit-breakers.

Note
The same standards prescribe type tests for AS switchboards (standard factory manufactured switchgear), including those for maximum temperature rise.

Current-carrying capacity in switchgear

As an example, the following table shows the continuous current carrying capacity for circuit-breakers installed in a switchgear with the following dimensions: 1800 x 500 x 600 (HxWxD). These values refer to withdrawable version circuit-breaker installed in non-segregated switchgear with a degree of protection up to IP31.
The values refer to a maximum temperature at the terminals of 120°C.

X1 Vertical terminals in a IP31 switchgear (H=1800, W=500, D=600)

	35° C	45° C	55°C	busbars	section
X1 B/N/L 06	630	630	630	2x40x5	400
X1 B/N/L 08	800	800	800	2x50x5	500
X1 B/N 10	1000	1000	1000	2x50x8	800
X1 L 10	1000	1000	1000	2x50x8	800
X1 B/N 12	1250	1250	1250	2x50x8	800
X1 L 12	1250	1205	1050	2x50x8	800
X1 B/N 16	1520	1440	1330	2x50x10	1000

X1 Horizontal terminals in a IP31 switchgear (H=1800, W=500, D=600)

	35° C	45° C	55°C	busbars	section
X1 B/N/L 06	630	630	630	2x40x5	400
X1 B/N/L 08	800	800	800	2x50x5	500
X1 B/N 10	1000	1000	1000	2x50x10	1000
X1 L 10	1000	1000	950	2x50x10	1000
X1 B/N 12	1250	1250	1160	2x50x10	1000
X1 L 12	1250	1125	955	2x50x10	1000
X1 B/N 16	1440	1360	1290	3x50x8	1200

Note
The tables should be used solely as a general guideline for selecting products.
Due to the extensive variety of switchgear construction shapes and conditions that can affect the behavior of the apparatus, the solution used must always be verified.

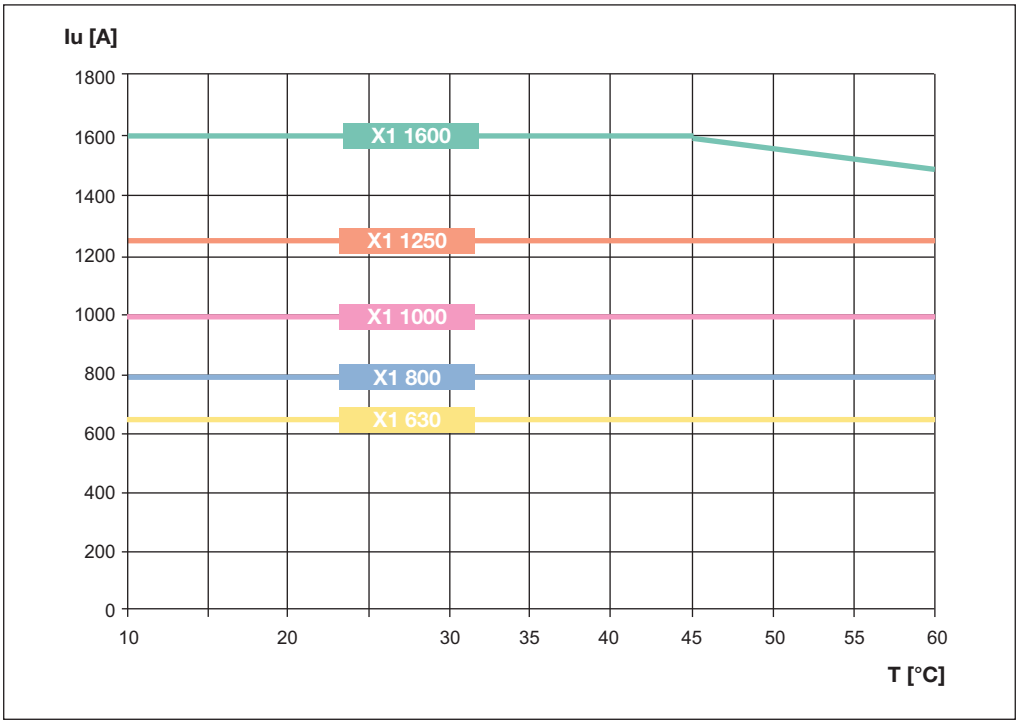
Changing the rated uninterrupted current in relation to the temperature

Temperature derating

The circuit-breakers can operate at higher temperatures than their reference temperature (40 °C) under certain installation conditions. In these cases the current-carrying capacity of the switchgear should be reduced.
The Emax series of air circuit-breakers uses electronic trip units which offer the benefit of great operating stability when subjected to temperature changes.
The tables below show the current-carrying capacities of the circuit-breakers (as absolute values and percentage values) in relation to their rated values at T = 40 °C (temperature inside the switchboard around the circuit-breaker and its connections).

Withdrawable X1 - horizontal rear

Temperature	X1 630		X1 800		X1 1000		X1 1250		X1 1600	
[°C]	%	[A]	%	[A]	%	[A]	%	[A]	%	[A]
10	100	630	100	800	100	1000	100	1250	100	1600
20	100	630	100	800	100	1000	100	1250	100	1600
30	100	630	100	800	100	1000	100	1250	100	1600
40	100	630	100	800	100	1000	100	1250	100	1600
45	100	630	100	800	100	1000	100	1250	100	1600
50	100	630	100	800	100	1000	100	1250	97	1550
55	100	630	100	800	100	1000	100	1250	94	1500
60	100	630	100	800	100	1000	100	1250	93	1480

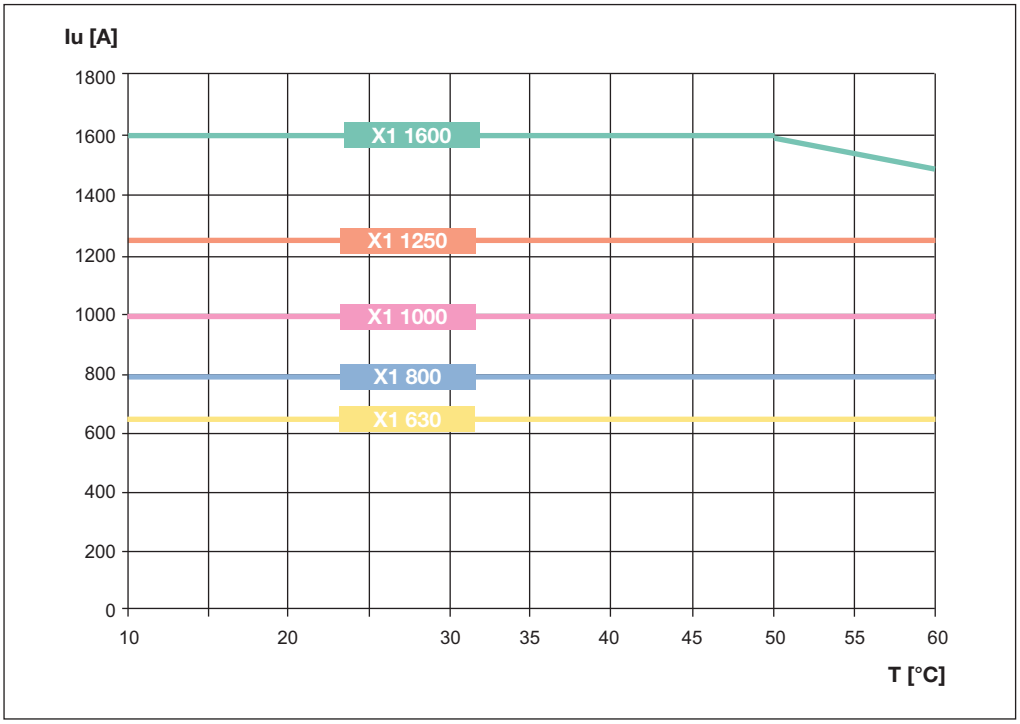


Changing the rated uninterrupted current in relation to the temperature

Temperature derating

Withdrawable X1 - vertical rear

Temperature	X1 630		X1 800		X1 1000		X1 1250		X1 1600	
[°C]	%	[A]	%	[A]	%	[A]	%	[A]	%	[A]
10	100	630	100	800	100	1000	100	1250	100	1600
20	100	630	100	800	100	1000	100	1250	100	1600
30	100	630	100	800	100	1000	100	1250	100	1600
40	100	630	100	800	100	1000	100	1250	100	1600
45	100	630	100	800	100	1000	100	1250	100	1600
50	100	630	100	800	100	1000	100	1250	100	1600
55	100	630	100	800	100	1000	100	1250	98	1570
60	100	630	100	800	100	1000	100	1250	95	1520



Derating at different altitudes

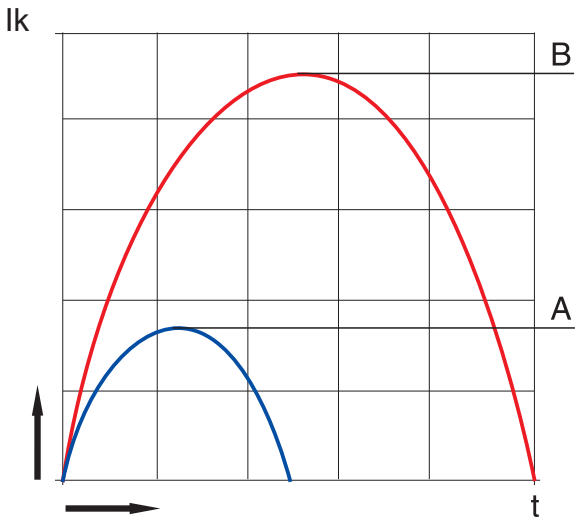
Emax X1 air circuit-breakers as well as the other sizes in the Emax family, do not undergo any changes in their rated performance up to an altitude of 2000 meters.
As the altitude increases the atmospheric properties alter in terms of composition, dielectric capacity, cooling power and pressure.
The performance of the circuit-breakers therefore undergoes derating, which can be measured through the variation in significant parameters such as the maximum operating voltage and the rated uninterrupted current.
The table below shows these values in relation to altitude.

Altitude	**H**	[m]	<2000	3000	4000	5000
Rated service voltage	**Ue**	[V]	690	600	500	440
Rated current	**In**	[A]	In	0.98xIn	0.93xIn	0.90xIn

Current-limiting and specific let-through energy curves for X1L limiting circuit-breakers

The current-limiting capacity of a current-limiting circuit-breaker indicates its greater or lesser capacity, under short-circuit conditions, to let through or make a current lower than the prospective fault current.
This characteristic is shown by two different curves which indicate the following, respectively:
– the value of the specific energy "I^2t" (in A^2s) let through by the circuit-breaker in relation to the uninterrupted symmetrical short-circuit current.
– the peak value (in kA) of the limited current in relation to the uninterrupted symmetrical short-circuit current.

The graph shown at the side schematically indicates the trend of the uninterrupted current, with the relative established peak (curve B), and the trend of the limited current with the lowest peak value (curve A).
Comparing the areas beneath the two curves shows how the specific let-through energy is reduced as a result of the limiting effects of the circuit- breaker.

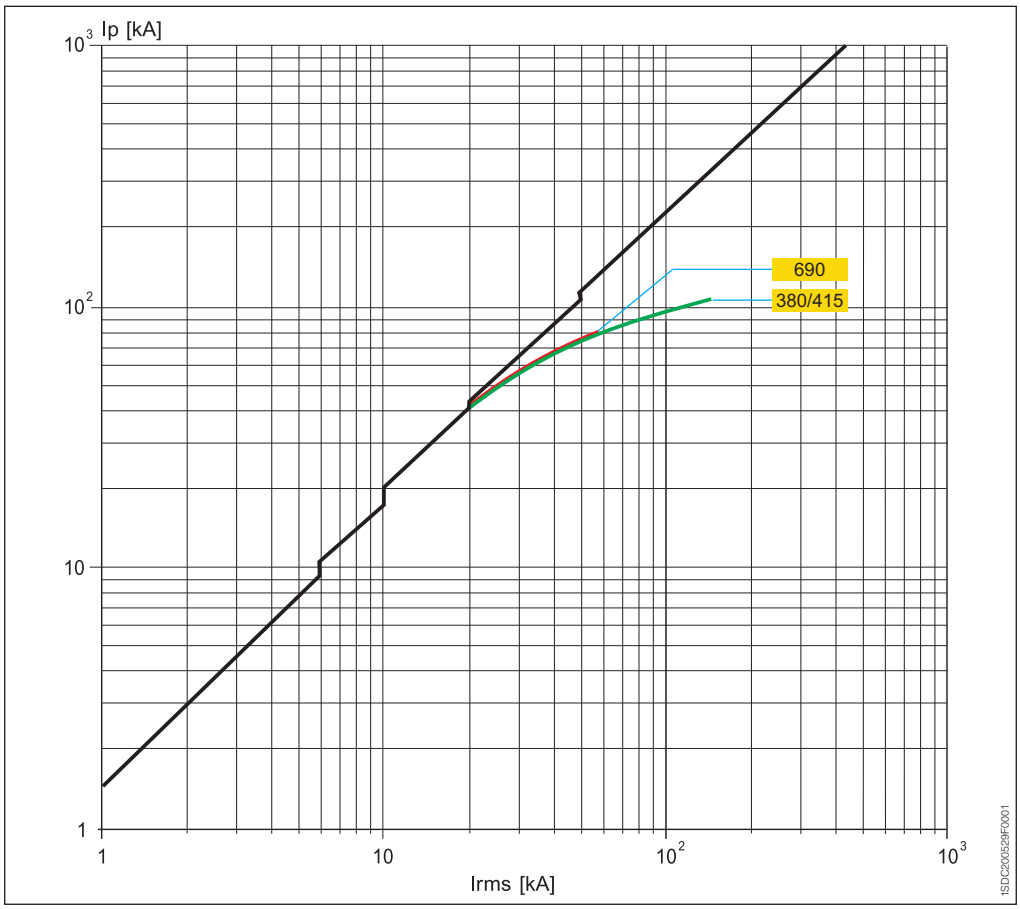


A peak limited Ik
B prospective Ik (peak value)

1SDC200091F0001

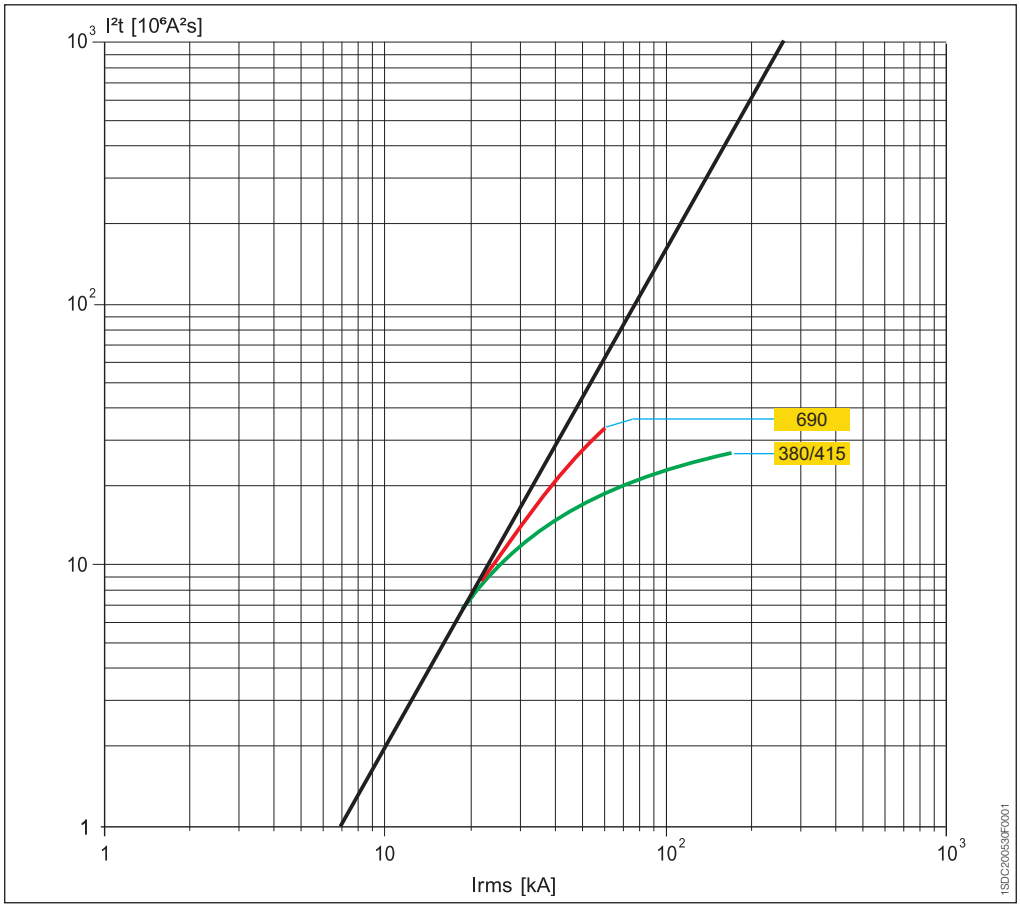
X1L

Current-limiting curves



X1L

Specific let-through energy curves



Irms prospective symmetrical short-circuit current

Ip peak current

I²t specific let-through energy at the voltages indicated