



Technical catalogue - Preliminary

SACE Tmax VF and Emax VF

Low voltage circuit-breakers for variable frequency applications



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SACE Tmax VF and SACE Emax VF

Low Voltage circuit-breakers for applications at variable frequency

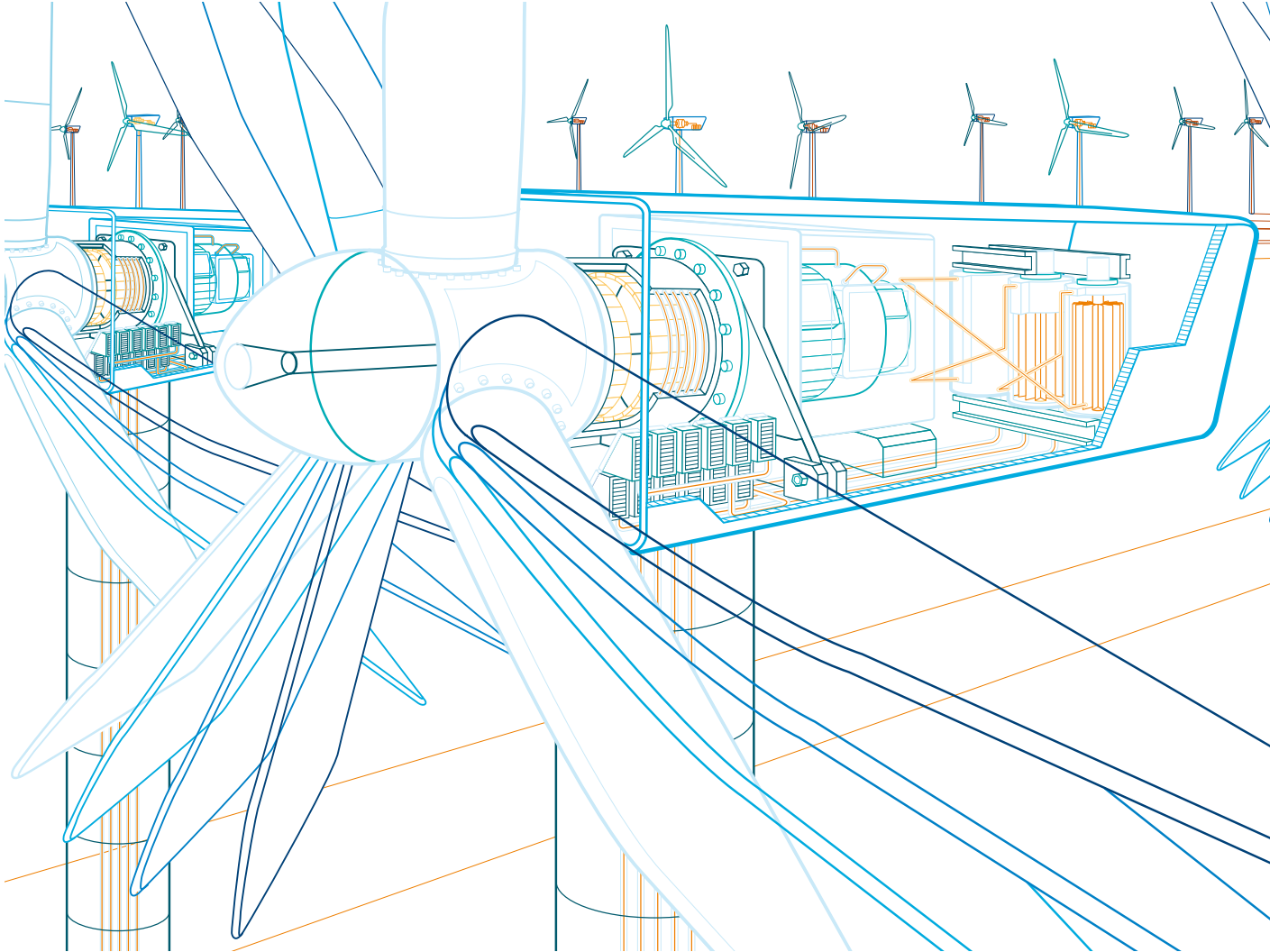


ABB SACE presents its innovative solution for protecting plants with variable frequency for applications in the wind, mini-hydro-electric, wave and traction power sectors.

Once again ABB SACE is ahead of trends and, as a first on the market, comes out with circuit-breakers able to operate in a range of frequencies from 1 to 200Hz.

The major benefits of this new range of circuit-breakers for applications at variable frequency are:

- **Optimal protection** of generators and users against overload and short-circuit over the whole range of frequency from 1 to 200Hz;
- **Compatibility** with all types of generators, even in overspeed running, thanks to the high rated voltage of the circuit-breakers (up to 1000V);
- **Standardisation** of switchboard design, regardless of the end market, and optimization of stock management thanks to dual IEC/UL circuit-breaker marking.

ABB has always paid special attention to renewable energy generation, constantly collaborating alongside the major wind turbine manufacturers, sensing the need ahead of others to protect plants with variable frequency.



From the experience gained in designing air and moulded-case circuit-breakers, the new range of SACE Tmax VF and SACE Emax VF circuit-breakers has come into being for applications at variable frequency.

The new range of SACE Tmax VF and SACE Emax VF circuit-breakers is the ideal solution for applications at variable frequency thanks to:

- New electronic trip units and optimised current sensors, along with ABB SACE technologies, able to ensure a high level of accuracy and precision of the protections when the frequency varies;
- Arc-breaking chambers and main contacts developed to ensure high breaking capacities over the whole frequency range;
- Circuit-breaker design and use of high-performing materials allowing operation up to 1000V;
- Extensive testing and periodic follow-ups with the certifying bodies make certification of the circuit-breaker according to the International IEC60947, UL1066 and UL489 Standards possible.



Main characteristics

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Main characteristics

Distinguishing Features of the Series

Performances

- Operating frequency from 1 up to 200Hz
- Rated uninterrupted current I_u from 800A up to 5000A
- Rated service voltage of 1000V
- High breaking capacity over the whole range of frequency

Operating Frequency

By means of SACE VFT (Variable Frequency Technology) the Tmax VF and Emax VF circuit-breakers can operate in an extended range of frequency: from 1Hz up to 200Hz.



The new family of trip units together with optimized current sensors ensures high precision of the protection functions for an extended frequency range. Whilst improved arcing chamber and main contacts guarantee high performances in terms of breaking capacity over the whole frequency range.

The overcurrent protection for variable frequency installations uses four types of trip units according to the rated current and frequency range:

- Thermomagnetic: for low frequency (1...60Hz) up to 800A
- PR222/VF: for high frequency (20...200Hz) up to 800A
- PR122/VF: for low frequency (1..60Hz) up to 2500A
- PR111/VF: for high frequency (20...200Hz) up to 5000A

Operating temperature

The Tmax VF and Emax VF circuit-breakers can be used in ambient conditions where air temperature varies between -25 °C and +70 °C (-13°F and +158 °F).



Compliance with Standards

SACE Tmax VF and SACE Emax VF circuit-breakers and their accessories conform to the International IEC 60947, EN 60947 (harmonized in 30 CENELEC countries), CEI EN 60947 and IEC 61000 Standards, and comply with the following EC directives:

- “Low Voltage Directive” (LVD) no 73/23 EEC
- “Electromagnetic Compatibility Directive” (EMC) nr. 89/336 EEC.



Furthermore, the Tmax VF automatic circuit-breakers and their electrical accessories also conform to the UL 489 (Underwriters Laboratories Incorporated), while the SACE Emax VF circuit-breakers for high frequency applications and switch-disconnector are UL 1066 certified, allowing their use in UL 1558 switchgear and UL 891 Low Voltage switchboards.

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 LOVAG organization (Low Voltage Agreement Group), and by the Swedish SEMKO certification organization, recognized by the International IECCE organization.

Resistance to shock and vibration

The circuit-breakers are unaffected by vibrations generated mechanically or due to electromagnetic effects, in compliance with the IEC 60068-2-6 Standards and the regulations of the major classification organizations:

- RINA (Italian Naval Register)
- Det Norske Veritas
- Bureau Veritas
- Lloyd’s register of shipping
- Germanischer Lloyd
- ABS (American Bureau of Shipping)
- RMRS (Russian Maritime Register of Shipping)



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

Main characteristics

Distinguishing Features of the Series



Insulation Behaviour

In the open position, the circuit-breakers comply with the IEC 60947-2 Standard. The oversized insulation distances guarantee there are no leakage currents as well as dielectric resistance to any overvoltages between the input and output.

Versions and connections

All the circuit-breakers are available in the fixed and withdrawable, three pole versions. The availability of various types of terminals makes it possible to build switchboards against the wall, or for the switchboard to be accessed from behind with rear connections. Moreover, the Tmax VF circuit-breakers can be installed in switchboards mounted in a horizontal or vertical position or on their backs, without undergoing any derating.





The ranges

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The ranges

Automatic circuit-breaker for Low Frequency applications

		T6 VF	E2 VF	E3 VF	
Performance level		L	N	H	
Number of poles		3	3	3	
Operating Frequency	[Hz]	1...60	1...60	1...60	
Version [Fixed (F), Drawout (W)]		F, W	F, W	F, W	
Operating temperature	[°C]	-25...+70	-25...+70	-25...+70	
Storage temperature	[°C]	-40...+70	-40...+70	-40...+70	
Reference standards		IEC 60947-2 UL 489	IEC 60947-2 -	IEC 60947-2 -	
Currents					
Rated uninterrupted current (at 50/60Hz, 40°C) Iu	[A]	800 ⁽¹⁾	1200 1600	2000 2500	
IEC 60947-2 (at 10...60Hz) ⁽²⁾					
Rated service voltage Ue	[V]	1000	1000	1000	
Rated insulation voltage Ui	[V]	1000	1250	1250	
Rated impulse withstand voltage Uimp	[kV]	8	8	8	
Rated ultimate short-circuit breaking capacity Icu					
690 V	[kA]	10 ⁽⁴⁾	15	20	
1000 V	[kA]	5	10	15	
Rated service short-circuit breaking capacity Ics					
690 V	[kA]	7.5 ⁽⁴⁾	15	20	
1000 V	[kA]	2.5	10	15	
Rated short-time withstand current Icw (1s)	[kA]	5	10	15	
Rated short-circuit making capacity (peak value) Icm					
690 V	[kA]	21	31.5	42	
1000 V	[kA]	10.5	21	31.5	
Utilisation category (in accordance with IEC 60947-2)		A	A	A	
Insulation behavior (in accordance with IEC 60947-2)		■	■	■	
UL 489 (at 10...60Hz) ⁽²⁾					
Rated voltage	[V]	600	-	-	
Rated short circuit current					
240 V	[kA]	10	-	-	
480 V	[kA]	10	-	-	
600 V	[kA]	10	-	-	
Trip units for variable frequency applications		Thermomagnetic	PR122/VF	PR122/VF	
Overall dimensions					
Fixed:	H	[mm/in]	361/14.21	418/16.46	418/16.46
	D	[mm/in]	103.5/4.07	302/11.89	302/11.89
	W	[mm/in]	210/8.26	296/11.65	404/15.91
Draw out:	H	[mm/in]	295/11.6	461/18.15	461/18.15
	D	[mm/in]	190.5/7.5	396.5/15.61	396.5/15.61
	W	[mm/in]	260/10.2	324/12.76	432/17.01
Weights (Circuit-breaker complete with trip unit, RH terminals, CS, excluding accessories)					
Fixed		[kg/lbs]	9.5/20.9	50/110	66/145
Draw out		[kg/lbs]	12.1/26.6	78/172	104/229
Mechanical life with regular ordinary maintenance ⁽³⁾	[No. Operations x 1000]		12	12	10
Operations frequency	[Operation/hour]		120	30	30
Electrical life at 690V at 50/60Hz ⁽²⁾	[No. Operations x 1000]		2.5	10	7
Operations frequency	[Operation/hour]		60	30	20

(1) Power supply only from the top; (2) For different frequencies please contact ABB SACE; (3) Operated by shunt releases, motor;

(4) For frequencies between 10Hz and 15Hz, Icu=7.5kA, Ics=5kA.

Note: Due to lack of relevant standards for variable frequency applications, these values are defined according to ABB SACE evaluation and testing procedure, and must be confirmed according to the specific customer application.

The ranges

Automatic circuit-breaker for High Frequency applications

		T6 VF	E2 VF	E3 VF	E4 VF	E6 VF	
Performance level		L	N	H	H	H	
Number of poles		3	3	3	3	3	
Operating Frequency	[Hz]	20...200	20...200	20...200	20...200	20...200	
Version [Fixed (F), Drawout (W)]		F, W	F, W	F, W	F, W	F, W	
Operating temperature	[°C]	-25...+70	-25...+70	-25...+70	-25...+70	-25...+70	
Storage temperature	[°C]	-40...+70	-40...+70	-40...+70	-40...+70	-40...+70	
Reference standards		IEC 60947-2 UL 489	IEC 60947-2 UL 1066	IEC 60947-2 UL 1066	IEC 60947-2 UL 1066	IEC 60947-2 UL 1066	
Currents							
Rated uninterrupted current (at 50/60Hz, 40°C) I _u	[A]	800 ⁽¹⁾	1200 1600	2000 2500	3600	5000	
IEC 60947-2							
Rated service voltage U _e	[V]	1000	1000	1000	1000	1000	
Rated insulation voltage U _I	[V]	1000	1250	1250	1250	1250	
Rated impulse withstand voltage U _{imp}	[kV]	8	12	12	12	12	
Rated ultimate short-circuit breaking capacity I_{cu}							
690 V	[kA]	10	15	20	25	25	
1000 V	[kA]	5	10	15	20	20	
Rated service short-circuit breaking capacity I_{cs}							
690 V	[kA]	7.5	15	20	25	25	
1000 V	[kA]	2.5	10	15	20	20	
Rated short-time withstand current I _{cw} (1s)	[kA]	5	10	15	20	20	
Rated short-circuit making capacity (peak value) I_{cm}							
690 V	[kA]	21	31.5	42	52.5	52.5	
1000 V	[kA]	10.5	21	31.5	42	42	
Utilisation category (in accordance with IEC 60947-2)		A	A	A	A	A	
Insulation behavior (in accordance with IEC 60947-2)		■	■	■	■	■	
UL 489 and 1066							
Rated voltage	[V]	UL489 600	600	UL1066 600	600	600	
Rated short circuit current							
240 V	[kA]	10	15	20	25	25	
480 V	[kA]	10	15	20	25	25	
600 V	[kA]	10	15	20	25	25	
Rated short time current	[kA]	-	15	20	25	25	
Trip units for variable frequency applications		PR222/VF	PR111/VF	PR111/VF	PR111/VF	PR111/VF	
Overall dimensions							
Fixed:	H	[mm/in]	361/14.21	418/16.46	418/16.46	418/16.46	418/16.46
	D	[mm/in]	103.5/4.07	302/11.89	302/11.89	302/11.89	302/11.89
	W	[mm/in]	210/8.26	296/11.65	404/15.91	566/22.28	782/30.79
Draw out:	H	[mm/in]	295/11.6	461/18.15	461/18.15	461/18.15	461/18.15
	D	[mm/in]	190.5/7.5	396.5/15.61	396.5/15.61	396.5/15.61	396.5/15.61
	W	[mm/in]	260/10.2	324/12.76	432/17.01	594/23.39	810/31.89
Weights (Circuit-breaker complete with trip unit, RH terminals, CS, excluding accessories)							
Fixed	[kg/lbs]	9.5/20.9	50/110	66/145	97/214	140/308	
Draw out	[kg/lbs]	12.1/26.6	78/172	104/229	147/324	210/463	
Mechanical life with regular ordinary maintenance ⁽²⁾	[No. Operations x 1000]	12	12	10	8	8	
Operations frequency	[Operation/hour]	120	30	30	30	30	
Electrical life at 690V at 50/60Hz ⁽³⁾	[No. Operations x 1000]	2.5	10	7	4	2	
Operations frequency	[Operation/hour]	60	30	20	10	10	

(1) Power supply only from the top; (2) Operated by shunt releases, motor; (3) For different frequencies please contact ABB SACE.

Note: Due to lack of relevant standards for variable frequency applications, these values are defined according to ABB SACE evaluation and testing procedure, and must be confirmed according to the specific customer application.

The ranges

Switch disconnecter for variable frequency applications

The switch-disconnectors are derived from the corresponding circuit-breakers for variable frequency applications, 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 trip units.

The switch-disconnectors, can be used according to category of use AC-22B in accordance with the IEC 60947-3 Standard.

The electrical specifications of the switch-disconnectors are listed in the table below.

		T6D/VF	E2N/VF MS	E3H/VF MS	E4H/VF MS	E6H/VF MS
Number of poles		3	3	3	3	3
Operating Frequency ⁽¹⁾	[Hz]	1...200	1...200	1...200	1...200	1...200
Version [Fixed (F), Drawout (W)]		F, W	F, W	F, W	F, W	F, W
Operating temperature	[°C]	-25...+70	-25...+70	-25...+70	-25...+70	-25...+70
Storage temperature	[°C]	-40...+70	-40...+70	-40...+70	-40...+70	-40...+70
Reference standards		IEC 60947-3 -	IEC 60947-3 UL 1066	IEC 60947-3 UL 1066	IEC 60947-3 UL 1066	IEC 60947-3 UL 1066
Currents						
Rated uninterrupted current (at 50/60Hz, 40°C) I_u	[A]	800 ⁽²⁾	1200 1600	2000 2500	3600	5000
IEC 60947-3						
Rated service voltage U_e	[V]	1000	1000	1000	1000	1000
Rated insulation voltage U_i	[V]	1000	1250	1250	1250	1250
Rated impulse withstand voltage U_{imp}	[kV]	8	12	12	12	12
Rated short-time withstand current I_{cw} (1s)	[kA]	9.6	19.2	30	43.2	60
UL 1066						
Rated voltage	[V]	-	600	600	600	600
Rated short circuit current	[kA]	-	15	20	25	25

(1) For frequency lower than 10Hz, please contact ABB SACE

(2) Power supply only from the top

Note: Due to lack of relevant standards for variable frequency applications, these values are defined according to ABB SACE evaluation and testing procedure, and must be confirmed according to the specific customer application.



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Installation

Applications of the circuit-breaker

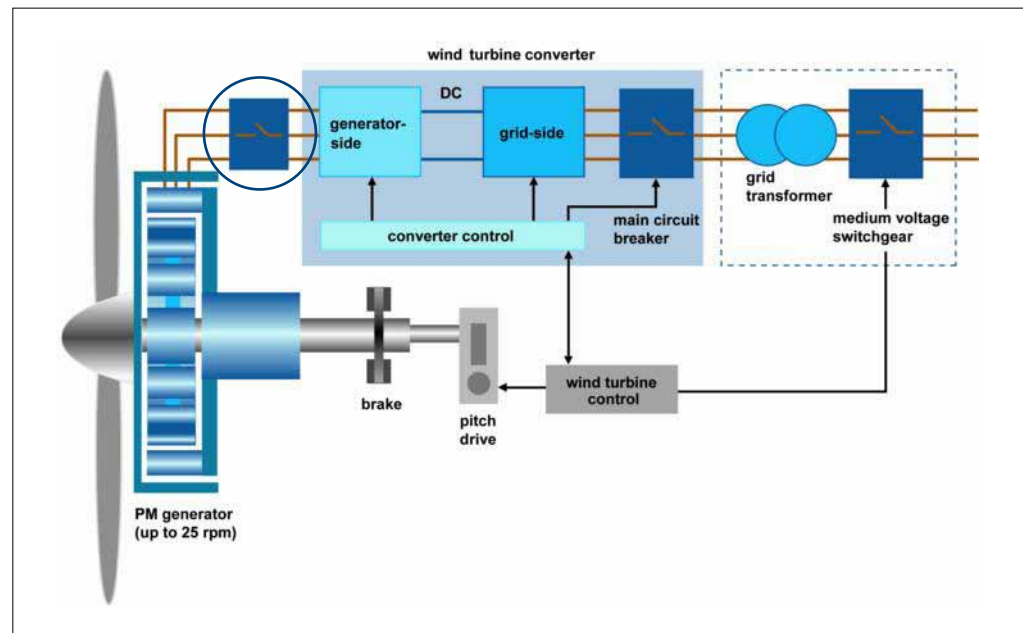
The circuit breakers for variable frequency applications is typically installed in wind turbine full converter concepts. On these turbines, the converter decouples the synchronous (permanent magnet) and asynchronous generator and the mechanical drivetrain from the grid. The power generated in a wide range of frequencies flows through the converter to the grid.

The main purposes of the circuit breaker installed in the variable frequency side are:

- protection against fault involving the inverter or the connections between the generator and the inverter (e.g. cable section);
- backup of the embedded inverter protection functions to give a redundancy disconnection of the generator in case of fault;
- safe insulation of the electric power source for normal operation and maintenance activities (circuit breaker controlled by the inverter automation system).

Application examples:

Full converter concept low speed permanent magnet generator



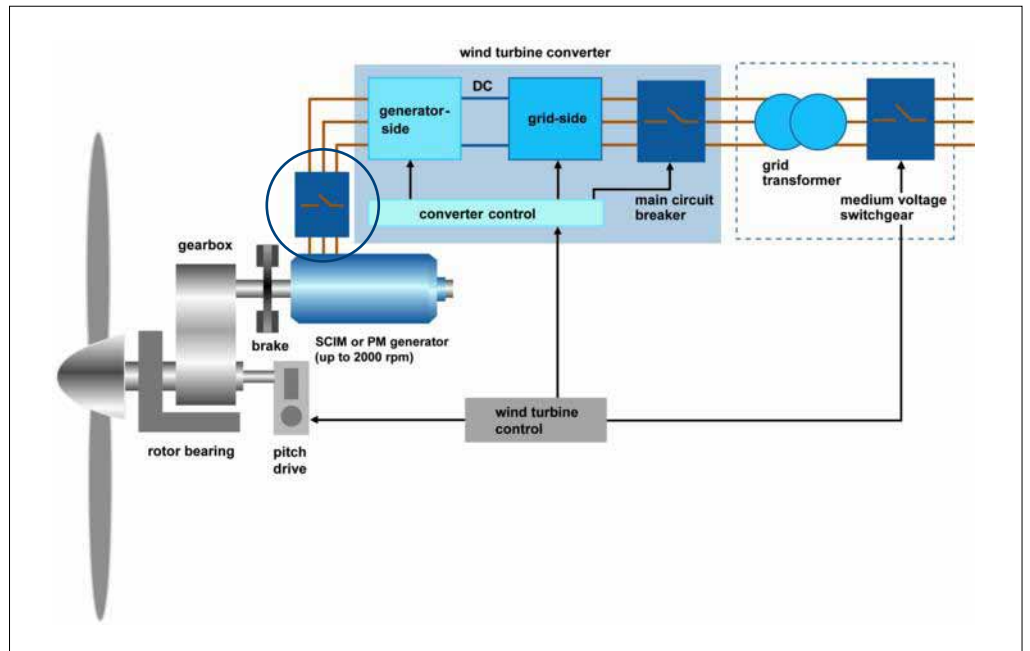
Wind turbine electrical system operating conditions:

- Rated power $P_n = 2000$ kW
- Rated voltage $U_n = 690$ V
- Rated current $I_n = 2100$ A
- Rated frequency $f_n = 16$ Hz
- Maximum voltage in over speed: 970V
- Maximum fault current: 5500A @ 690V @ 16Hz
- Operating frequency range $f = 4 \dots 19$ Hz

Circuit breaker electrical data:

- Emax E3/VF
- Over current release: PR122/VF for variable frequency
- Rated service voltage $U_e: 1000$ V
- Rated uninterrupted current $I_u: 2500$ A
- Service frequency: 1...60Hz

Full converter concept high speed permanent magnet generator



Wind turbine electrical system operating conditions:

- Rated power $P_n = 750 \text{ kW}$
- Rated voltage $U_n = 690\text{V}$
- Rated current $I_n = 770\text{A}$
- Rated frequency $f_n = 100\text{Hz}$
- Maximum voltage in over speed: 900V
- Maximum fault current: $3000\text{A @ } 690\text{V @ } 100\text{Hz}$
- Operating frequency range $f = 30 \dots 125\text{Hz}$

Circuit breaker electrical data:

- Tmax T6/VF
- Over current release: PR222/VF for variable frequency
- Rated service voltage $U_e: 1000\text{V}$
- Rated uninterrupted current $I_u: 800\text{A}$
- Service frequency: $20 \dots 200\text{Hz}$

Installation

Frequency performances

Changing the rated uninterrupted current in relation to the frequency

At high frequencies, the current-carrying capacities of the circuit-breakers are reclassified to take into account the increase of the skin effect and the increase of the inductive reactance. These phenomena cause overheating of the conductor or of the copper components which normally carry the current in the circuit-breaker, thus the maximum setting for protection against overloads I_n must be reduced.

The table below shows the current-carrying capacity of the circuit-breakers (as absolute values and percentage values) in relation to their reference values at $f = 50/60\text{Hz}$.

Frequency [Hz]	T6L/VF 800		E2N/VF 1200		E2N/VF 1600		E3H/VF 2000		E3H/VF 2500		E4H/VF 3600		E6H/VF 5000	
	%	[A]	%	[A]	%	[A]	%	[A]	%	[A]	%	[A]	%	[A]
1...60	100	800	100	1200	100	1600	100	2000	100	2500	100	3600	100	5000
61...80	99.5	796	90	1080	90	1440	90	1800	90	2250	90	3240	90	4500
81...100	99	792	84	1008	84	1344	84	1680	84	2100	84	3024	84	4200
101...120	98.5	788	80	960	80	1280	80	1600	80	2000	80	2880	80	4000
121...140	98	784	76	912	76	1216	76	1520	76	1900	76	2736	76	3800
141...160	97.5	780	74	888	74	1184	74	1480	74	1850	74	2664	74	3700
161...180	97	776	72	864	72	1152	72	1440	72	1800	72	2592	72	3600
181...200	96.5	772	70	840	70	1120	70	1400	70	1750	70	2520	70	3500

Installation

Temperature performances

Changing the rated uninterrupted current in relation to the temperature

SACE Tmax T6L/VF 800 with thermal magnetic trip units

The circuit-breakers fitted with thermal magnetic trip units have their thermal element set for a reference temperature of +40 °C (104 °F).

The following table shown the deviation, with the same setting, for temperatures other than 40 °C.

In [A]	10°C	20°C	30°C	40°C	50°C	60°C	70°C
800	685...965	640...905	605...855	560...800	520...740	470...670	420...610

SACE Tmax T6L/VF 800 with PR222/VF and T6D/VF 800

The electronic trip units do not undergo any variations in performance as the temperature varies except in cases of temperatures exceeding +40 °C (104 °F).

Then, the maximum setting for protection against overloads L must be reduced, as indicated in the tables, to take into account the heating phenomena which occur in the current carrying copper parts of the circuit-breaker.

Fixed

	up to 40 °C		50 °C		60 °C		70 °C	
	I_{max} [A]	I_t	I_{max} [A]	I_t	I_{max} [A]	I_t	I_{max} [A]	I_t
FC - F	800	1	800	1	760	0.95	720	0.9
R (VR)	800	1	800	1	800	1	760	0.95
R (HR)	800	1	800	1	720	0.9	640	0.8

FC = Front cables terminals; F = Front flat terminals; R (HR) = Rear terminals (horizontal); R (VR) = Rear terminals (vertical)

Withdrawable

	up to 40 °C		50 °C		60 °C		70 °C	
	I_{max} [A]	I_t	I_{max} [A]	I_t	I_{max} [A]	I_t	I_{max} [A]	I_t
VR	800	1	800	1	760	0.95	720	0.9
HR	800	1	760	0.95	720	0.9	640	0.8

HR = Rear flat horizontal terminals; VR = Rear flat vertical terminals

Installation

Temperature performances

SACE EMAX VF

The circuit-breakers can operate at higher temperatures than their reference temperature (+40 °C/104 °F) under certain installation conditions. In these cases the current-carrying capacity of the switchgear should be reduced.

The SACE Emax VF 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.

Withdrawable SACE Emax VF

Temperature [°C]	E2N/VF 1200		E2N/VF 1600		E3H/VF 2000		E3H/VF 2500		E4H/VF 3600		E6H/VF 5000	
	%	[A]	%	[A]	%	[A]	%	[A]	%	[A]	%	[A]
10	100	1200	100	1600	100	2000	100	2500	100	3600	100	5000
20	100	1200	100	1600	100	2000	100	2500	100	3600	100	5000
30	100	1200	100	1600	100	2000	100	2500	100	3600	100	5000
40	100	1200	100	1600	100	2000	100	2500	100	3600	100	5000
45	100	1200	100	1600	100	2000	100	2500	100	3600	100	5000
50	100	1200	100	1600	100	2000	100	2500	100	3600	100	5000
55	100	1200	100	1600	100	2000	100	2500	100	3600	100	5000
60	100	1200	98	1570	100	2000	100	2500	97	3493	98	4910
65	100	1200	96	1538	100	2000	97	2425	94	3378	96	4815
70	100	1200	94	1510	100	2000	94	2350	90	3253	94	4720

Installation

Derating at different altitudes

SACE Tmax VF and Emax VF power circuit-breakers do not undergo any changes in their rated performance up to an altitude of 2000 meters (6600 ft).

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 rated operating voltage and the rated uninterrupted current.

The table below shows the values in relation to altitude.

Altitude	[ft]	6600	9900	13200	16500
	[m]	2000	3000	4000	5000
Rated insulation Voltage U_i	[% U_i]	100%	88%	78%	68%
Rated service voltage U_e	[% U_e]	100%	88%	78%	68%
Continuous current rating I_n	[% I_n]	100%	98%	95%	90%



Protection trip units and trip curves

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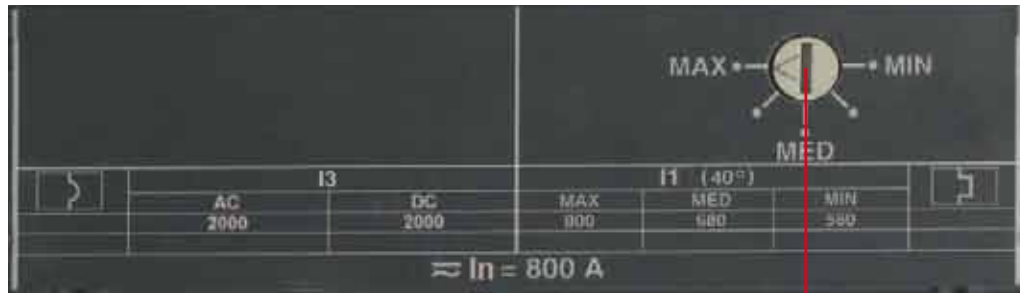
Protection trip units and trip curves

Thermal magnetic trip unit

Characteristics



The Tmax T6/VF circuit-breaker fitted with thermal magnetic trip unit is used to protect, against overload and short circuit, networks with a range of frequency from 1Hz to 60Hz.

The thermal magnetic trip unit TMD offers an adjustable thermal threshold, and a fixed low magnetic threshold making it especially suitable for protection of generators.



Selector to adjust the thermal threshold

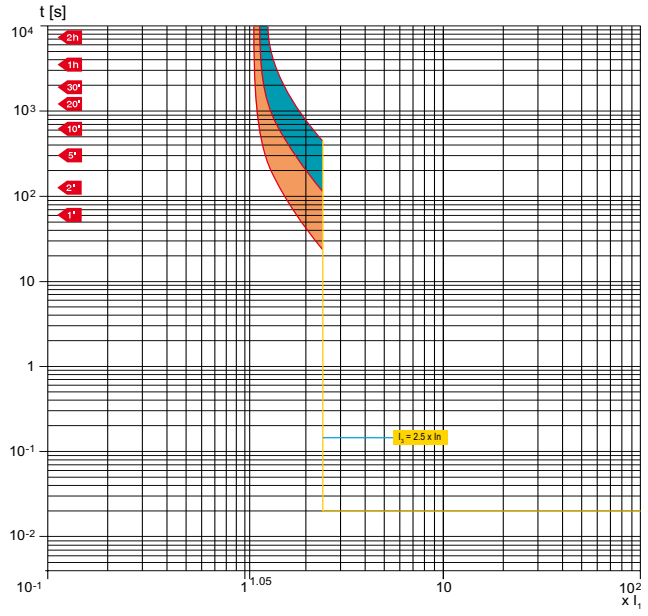
Protection functions and setting values - TMD

Function	Trip threshold	Working frequency
 Overload protection ⁽¹⁾	$I1 = 0.7 \dots 1 \times I_n$	1...60Hz
 Instantaneous short-circuit protection	$I3 = 2.5 \times I_n$	1...60Hz
Tolerance	$\pm 20\%$	

(1) Reference temperature at 40°C

TMD

L-I Functions



1SDC010018F0001

Protection trip units and trip curves

PR222/VF

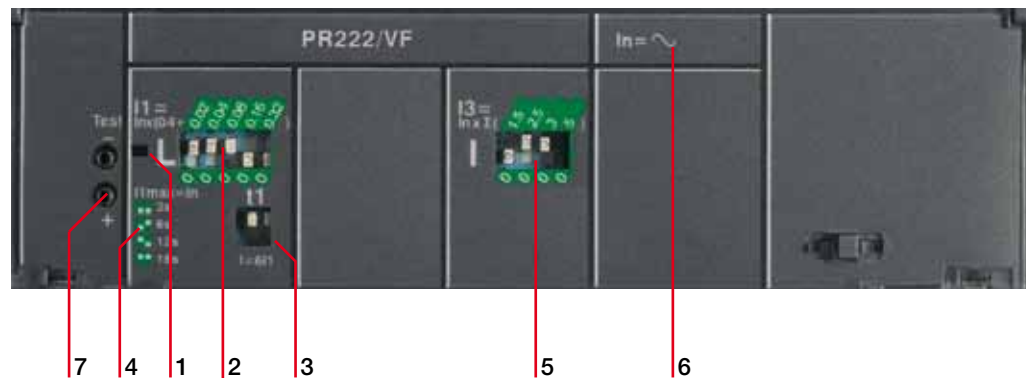


Characteristics

The new SACE PR222/VF for Tmax T6/VF is the unique and innovative trip unit ideal for installations operating at variable frequency.

By means of SACE VFT (Variable Frequency Technology) the new PR222/VF provides overloads and short circuits protection for an extended frequency range: from 20Hz to 200Hz.

The PR222/VF offers a wide combination of thresholds and trip times making it suitable for protection of generators, motors, cables and drives.



Caption

- | | | |
|---|---|--|
| 1 Alarm signal LED for protection function L | 4 Indication of the DIP switch positions for the time settings t1 | 6 Rating plate showing the rated current |
| 2 DIP switches for setting and values of current threshold I1 | 5 DIP switches for setting and values of current threshold I3 | 7 Socket for Ekip TT test unit |
| 3 DIP switches for setting trip time t1 | | |

Operation and protection functions

Power supply

The power supply needed for correct operation is supplied directly by the current sensors of the trip unit. The unit requires at least three phases to be loaded at 20% of the nominal current to operate.

Protection functions

The PR222/VF trip unit offers the following protection functions in the frequency range from 20Hz to 200Hz:

- overload (L)
- instantaneous short circuit (I)



User interface

The trip unit can be set by using the dip switches on the front.

One LED on the front of PR222/VF signals the pre-alarm and alarm of protection L. The pre-alarm threshold value, signaled by the red LED fixed, is equal to $0.9 \times I_1$. The alarm condition is signaled by the red LED flashing (0.5s ON/0.5s OFF).

It is also possible to remotely transmit the alarm of protection L by simply connecting connector X3 to the dedicated contact.

Protection functions and setting values - PR222/VF

Functions	Trip threshold	Trip time	Possible exclusion	Relation $t=f(I)$	Working frequency
 Overload protection	$I_1 = 0.40 - 0.42 - 0.44 - 0.46 - 0.48 - 0.50 - 0.52 - 0.54 - 0.56 - 0.58 - 0.60 - 0.62 - 0.64 - 0.66 - 0.68 - 0.70 - 0.72 - 0.74 - 0.76 - 0.78 - 0.80 - 0.82 - 0.84 - 0.86 - 0.88 - 0.90 - 0.92 - 0.94 - 0.96 - 0.98 - 1 \times I_n$	With current $I_f = 6 \times I_1$ $t_1 = 3s, 6s, 9s, 18s$	–	$t=k/I^2$	20...200Hz
	Tolerance	Release between $1.1 \dots 1.3 \times I_1^{(1)}$	$\pm 20\%$		
 Instantaneous short-circuit protection	$I_3 = 1.5 - 2.5 - 3 - 4 - 4.5 - 5 - 5.5 - 6.5 - 7 - 7.5 - 8 - 9 - 9.5 - 10.5 - x I_n$	instantaneous	■	$t=k$	20...200Hz
	Tolerance	$\pm 20\%$	$\leq 60ms$		

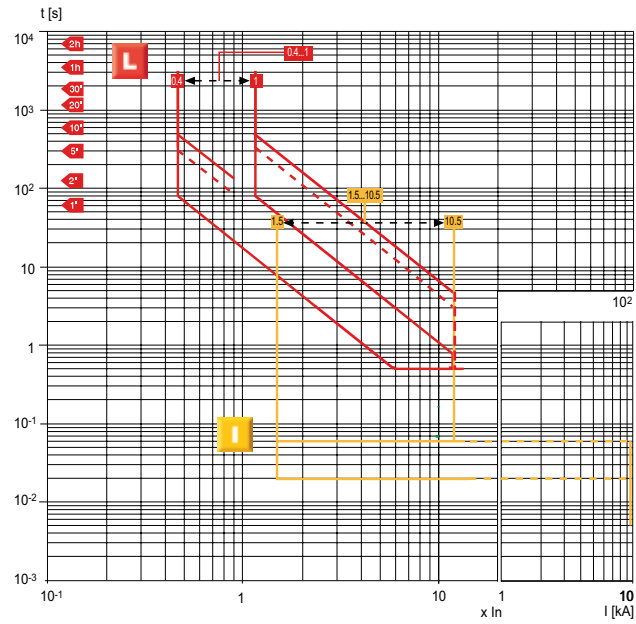
I_f = Fault current

(1) For frequency lower than 25Hz, release between $1.1 \dots 1.45 \times I_1$

Protection trip units and trip curves

PR222/VF

PR222/VF
L-I Functions



Protection trip units and trip curves

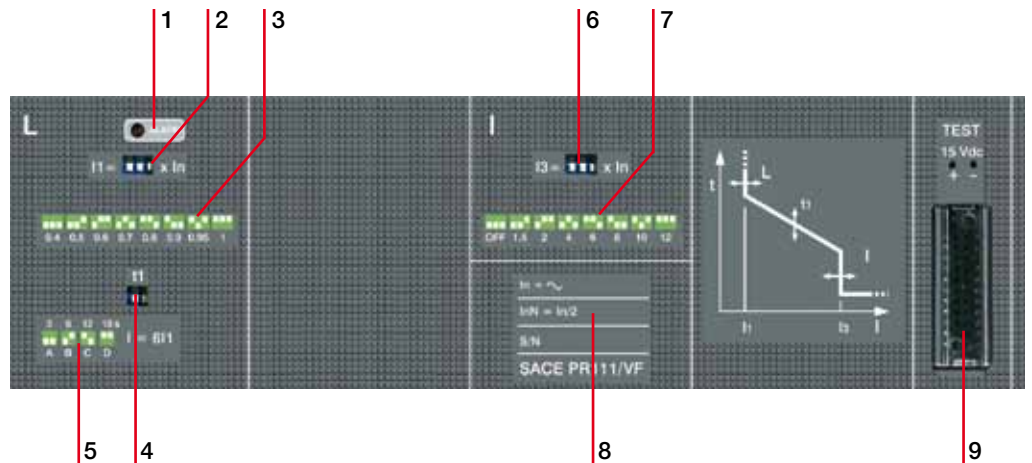
PR111/VF



Characteristics

The new SACE PR111/VF for Emax VF (E2, E3, E4 and E6) is the unique and innovative trip unit ideal for installations operating at variable frequency.

By means of SACE VFT (Variable Frequency Technology) the new PR111/VF provides overloads and short circuits protection for an extended frequency range: from 20Hz to 200Hz. The PR111/VF offers a wide combination of thresholds and trip times making it suitable for protection of generators, motors, cables and drives.



Caption

- | | | |
|---|---|---|
| 1 Alarm signal LED for protection function L | 4 DIP switches for setting trip time t_1 | 8 Rating plate showing the rated current and the trip unit serial number |
| 2 DIP switches for setting current threshold I_1 | 5 Indication of the DIP switch positions for the time settings t_1 | 9 Connection module with external units for testing the trip unit and socket for connection to the trip test (Ekip TT unit and SACE PR010/T unit) |
| 3 Indication of the DIP switch positions for the values of current thresholds I_1 | 6 DIP switches for setting current threshold I_3 | |
| | 7 Indication of the DIP switch positions for the values of current thresholds I_3 | |

Protection trip units and trip curves

PR111/VF

Operation and protection functions

Power supply

The unit requires no external power supply. It is self-supplied by means of the current transformers installed in the circuit-breaker. It requires at least three phases to be loaded at 20% of the nominal current (I_n) to operate.

Protection functions

The PR111/VF trip unit offers the following protection functions in the frequency range from 20Hz to 200Hz:

- overload (L)
- instantaneous short circuit (I)



Test function

A trip test can be carried out using the Ekip TT Trip Test unit. A complete test of the PR111/VF microprocessor based trip unit can be carried out using the special SACE PR010/T apparatus by applying it to the TEST connector.

User interface

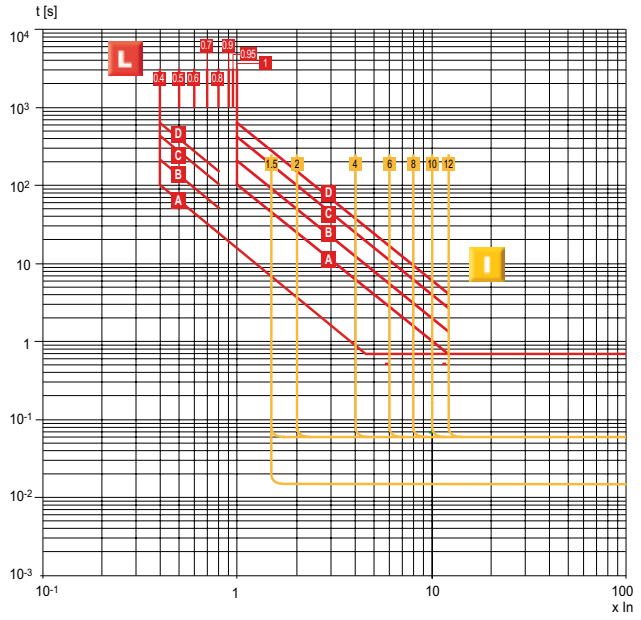
The trip unit can be set by using the dip switches on the front.
One LED is available for alarm signalling (timing start) for the L function.

Protection functions and setting values - PR111/VF

Function	Trip threshold	Trip Time	Possible exclusion	Relation $t=f(I)$	Working frequency
 Overload protection	$I_1 = 0.4 - 0.5 - 0.6 - 0.7 - 0.8 - 0.9 - 0.95 - 1 \times I_n$	With current $I_f = 6 \times I_1$ $t_1 = 3$ s (curve A), 6 s (curve B), 12 s (curve C), 18 s (curve D)	–	$t = k/I^2$	20...200Hz
Tolerance	Release between 1.05 and 1.2 x I_1	$\pm 20\%$			
 Instantaneous short-circuit protection	$I_3 = 1.5 - 2 - 4 - 6 - 8 - 10 - 12 \times I_n$	Instantaneous	■	$t = k$	20...200Hz
Tolerance	$\pm 20\%$	≤ 60 ms			

I_f = Fault current

PR111/VF
L-I Functions



Protection trip units and trip curves

PR122/VF



Characteristics

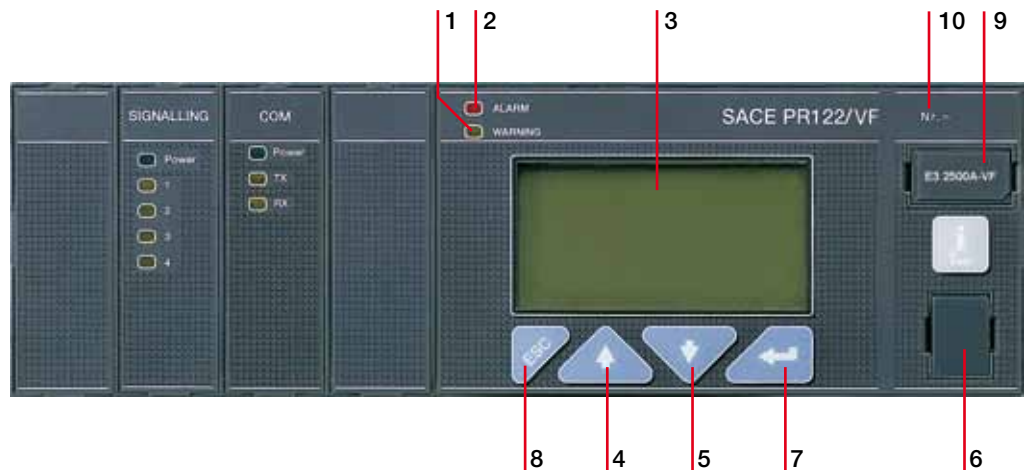
The new SACE PR122/VF for Emax E2/VF and E3/VF is the unique and innovative trip unit ideal for installations operating at variable frequency.

By means of SACE VFT (Variable Frequency Technology) the new PR122/VF provides overloads and short circuits protection for an extended frequency range: from 1Hz to 60Hz. The PR122/VF offers a wide combination of thresholds and trip times making it suitable for protection of generators, motors, cables and drives.

Access to information and programming using a keyboard and graphic liquid crystal display is extremely simple and intuitive.

An integrated ammeter and many other additional features are provided over and above the protection functions. These functions can be further increased with addition on board of the dialogue and signalling units.

All the thresholds and trip curve delays of the protection functions are stored in special memories which retain the information even when no power is supplied.



Caption

- | | | |
|----------------------------|---|--|
| 1 Warning LED | 6 Test connector for connecting or testing the trip unit by means of an external device | 9 Rating plug |
| 2 Alarm LED | 7 ENTER button to confirm data or change pages | 10 Serial number of protection trip unit |
| 3 Rear-lit graphic display | 8 Button to exit submenus or cancel operations (ESC) | |
| 4 Cursor UP button | | |
| 5 Cursor DOWN button | | |

Operation, protection functions and self-test

Power supply

The protection release PR122/VF requires the external power supply to activate the protection functions and the ammeter. The trip unit operates and the circuit-breaker is protected only in presence of the auxiliary power supply 24V DC.

ABB recommends to use a backup battery to guarantee the presence of the Vaux or to add in the circuit-breaker an undervoltage release (YU) to open the circuit-breaker even when the auxiliary Vaux does not work.

The characteristics of the power pack are given in the table below:

	PR122/VF	PR120/D-M	PR120/K
Auxiliary power supply (galvanically separated ⁽¹⁾)	24 V DC \pm 20%	from PR122/VF	from PR122/VF
Maximum ripple	5%		
Inrush current @ 24V	\sim 10 A for 5 ms		
Rated power @ 24V	\sim 3 W	+1 W	+1 W

(1) The external auxiliary power supply have to be provided using a galvanically-separated power pack dedicated only for one trip unit. Since the auxiliary voltage needs to be isolated from the ground, "galvanically separated converters" in accordance with the IEC standard 60950 (UL 1950) or the equivalent IEC 60364-41 have to be used to guarantee a current in common mode or leakage current (as defined in IEC 478/1) no greater than 3.5mA. The connections for the auxiliary power supply have to be made by a two-pole shielded twisted cable (e.g. type BELDEN 3105A/3105B), with the shield earthed on the trip unit side.

It is also possible to use the PR030/B Ultra portable battery unit (always provided with PR122/VF) to set the protection functions when the trip unit is not supplied by 24V DC.

Protection functions

The PR122/VF trip unit offers the following protection functions in the frequency range from 1 to 60Hz:

- overload (L)
- instantaneous short-circuit (I)
- self-protection against overtemperature (OT)

Setting the frequency

The PR122/VF is a new relay designed to work in a wide range of frequency. The working frequency can be set by selecting the nominal frequency (from 6.6Hz to 50Hz). Once the nominal frequency has been set, the trip unit works in a frequency range from 0.2 x fn to 1.25 x fn. The following table shows the possible nominal frequency values and the corresponding working range.

Nominal Frequency (fn)	Working range
6.6 Hz	1...8Hz
16.6 Hz	3...20Hz
25 Hz	5...30Hz
50 Hz	10...60Hz

Start-up function

The start-up function allows protection to operate with higher trip thresholds during the start-up phase. This avoids untimely tripping caused by the high inrush currents of certain loads like motors.

The start-up phase lasts from 100 ms to 1.5 s, in steps of 0.05 s. It is automatically recognized by the PR122/VF when the peak value of the maximum current exceeds 0.1 x In.

Protection trip units and trip curves

PR122/VF

Protection against overtemperature

The range of SACE PR122/VF trip unit allows the presence of abnormal temperatures, which could cause temporary or continuous malfunctions of the microprocessor, to be signalled to the user. The user has the following signals or commands available:

- lighting up of the “Warning” LED when the temperature is higher than 70 °C or lower than -20°C (temperature at which the microprocessor is still able to operate correctly)
- lighting up of the “Alarm” LED when the temperature is higher than 85 °C or lower than -25°C (temperature above which the microprocessor can no longer guarantee correct operation) and, when decided during the unit configuration stage, simultaneous opening of the circuit-breaker with indication of the trip directly on the display, as for the other protections.

Self-diagnosis

The PR122/VF range of trip units contains an electronic circuit which periodically checks the continuity of internal connections (trip coil or rating plug).

In the case of a malfunction an alarm message appears directly on the display. The Alarm is highlighted by the Alarm LED as well.

Test Functions

Once enabled from the menu, the “info/Test” pushbutton on the front of the trip unit allows correct operation of the chain consisting of the microprocessor, opening solenoid and circuit-breaker tripping mechanism to be checked.

The control menu also includes the option of testing correct operation of the display, signalling LEDs, and electrical contacts of the PR120/K trip unit.

When the auxiliary power supply is not present, the PR030/B Ultra unit can perform the trip test. By means of the front multi-pin connector it is possible to apply the Ekip T&P test and programming unit which allows the functions of the PR122/VF to be tested and checked.

User interface

The human-machine interface (HMI) of the device is made up of a wide graphic display, LEDs, and browsing pushbuttons. The interface is designed to provide maximum simplicity.

The language can be selected from among five available options: Italian, English, German, French and Spanish.

A password system is used to manage the “Read” or “Edit” modes, the default password, 0001, can be modified by the user.

The protection parameters (curves and trip thresholds) can be set directly via the HMI of the device. The parameters can only be changed when the trip unit is operating in “Edit” mode, but the information available and the parameter settings can be checked at any time in “Read” mode.

When a communication device (internal PR120/D-M module or external Ekip T&P, BT030-USB devices) is connected, it is possible to remotely set parameters.

Indicator LEDs

LEDs on the front panel of the trip unit are used to indicate all the pre-alarms (“WARNING”) and alarms (“ALARM”). A message on the display always explicitly indicates the type of event concerned.

Example of events indicated by the “WARNING” LED:

- pre-alarm for overload $I > 0.9 I_1$;
- first temperature threshold exceeded (70 °C);
- contact wear beyond 80%.

Example of events indicated by the “ALARM” LED:

- overload (may begin from $1.05 \times I_1 < I < 1.3 \times I_1$, in accordance with the standard IEC 60947-2);
- timing of function L;
- second temperature threshold exceeded (85 °C);
- contact wear 100%.

Data logger

By default PR122/VF is provided with the Data Logger function, that automatically records in a wide memory buffer the instantaneous values and waveforms of all the currents. Data can be easily downloaded from the unit by means of Ekip connect application using a USB port and can be transferred to any personal computer for elaboration. The function freezes the recording whenever a trip occurs, so that a detailed analysis of faults can be easily performed. Ekip connect allows also reading and downloading of all the others trip information.

- Number of channels: 3
- Maximum sampling rate: 4800 Hz
- Maximum sampling time: 27 s (@ sampling rate 600 Hz)
- 64 events tracking

Trip information and opening data

In case a trip occurs PR122/VF stores all the needed information:

- Protection tripped
- Opening data (current)
- Time stamp (date and time)

By pushing the "info/Test" pushbutton the trip unit shows all these data directly on display. The information of the latest 20 trips are permanently stored in memory.

Load control

Load control makes it possible to engage/disengage individual loads on the load side before the overload protection L is tripped, thereby avoiding unnecessary trips of the circuit-breaker on the supply side. This is done by means of contactors or switch-disconnectors (externally wired to the trip unit), controlled by the PR122/VF by PR120/K internal contacts.

Two different Load Control schemes can be implemented:

- disconnection of two separate loads, with different current thresholds
- connection and disconnection of a load, with hysteresis

Current thresholds and trip times are smaller than those available for selection with protection L, so that load control can be used to prevent overload tripping.

Internal PR120/K unit is required for Load Control.

Measurement function

The current measurement function (ammeter) is present on the SACE PR122/VF unit.

The display shows histograms showing the currents of the three phases on the main page. Furthermore, the most loaded phase current is indicated in numerical format.




Once the display is turned on, the minimum current for visualisation is $I > 10\%$ of the rating plug. Accuracy of the ammeter measurement chain (current sensor plus ammeter) is no more than 5% in the 50% - 120% current interval of I_n .

- Currents: three phases (L1, L2, L3);
- Instantaneous values of currents during a period of time (data logger);
- Maintenance: number of operations, percentage of contact wear, opening data storage (last 20 trips and 80 events).

Protection trip units and trip curves

PR122/VF

Protection functions and setting values - PR122/VF

Function	Trip threshold	Threshold step	Trip Time	Time step	Possible exclusion	Relation t=f(I)	Working frequency ⁽³⁾
 Overload protection ⁽¹⁾ Tolerance ⁽²⁾	$I1 = 0.4 \dots 1 \times I_n$ Release between 1.05 and $1.3 \times I1$	$0.01 \times I_n$	With current $I_f = 3 \times I1$ $t1 = 3 \text{ s} \dots 102 \text{ s}$ $\pm 20\%$	3 s	–	IEC60255-8	1...60Hz
 Instantaneous short-circuit protection Tolerance ⁽²⁾	$I3 = 1.5 \dots 10 \times I_n$ $\pm 20\%$	$0.1 \times I_n$	Instantaneous $\leq 60 \text{ ms}$	–	■	t=k	1...60Hz
 Protection against overtemperature	fixed ⁽⁴⁾	–	Instantaneous	–	–	temp=k	

I_f = fault current

The presence of external auxiliary power supply 24V DC is required to activate the protection functions.

(1) The minimum trip time is 0.5 s (self protection)

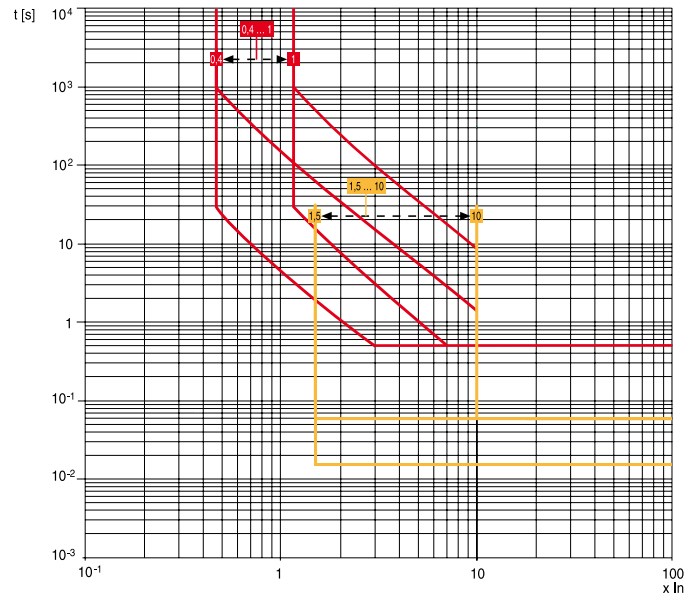
(2) These tolerances are valid within the frequency working range set

(3) According to the nominal frequency set:

Nominal Frequency	Working range
6.6 Hz	1...8Hz
16.6 Hz	3...20Hz
25 Hz	5...30Hz
50 Hz	10...60Hz

(4) Defined by ABB SACE, see page 4/12.

PR122/VF
L-I Functions



Protection trip units and trip curves

Optional modules

The electronic trip units for variable frequency applications can be fitted with the following optional modules, which are already available on the electronic devices for alternating current applications (50/60Hz).

Code	Accessory	Description	PR222/VF	PR111/VF	PR122/VF
1SDA066988R1	Ekip TT	Trip test unit	■	■	
1SDA058259R1	BT030-USB	Communication wireless unit			■
1SDA048964R1	PR010/T	Test and configuration unit		■	
1SDA066989R1	Ekip T&P	Test and configuration unit			■
free download	Ekip connect	Configuration software			■
1SDA058255R1	PR120/K	Internal signalling module (4 output with independent terminals)			■
1SDA058256R1	PR120/K	Internal signalling module (4 output + 1 input with a common terminal)			■
1SDA058254R1	PR120/D-M	Internal Modbus RTU communication module			■
1SDA055059R1	X3 - L alarm signal	Connector for fixed circuit-breaker	■		
1SDA055061R1	X3 - L alarm signal	Connector for draw out circuit-breaker	■		

For further information on the accessories, please consult Emax catalogue low voltage air circuit-breakers and Tmax catalogue low voltage moulded-case circuit-breakers.



Content

Electrical and mechanical accessories: Tmax	5/2
Connection terminals: Tmax	5/3
Electrical and mechanical accessories: Emax	5/4

Accessories

Electrical and mechanical accessories: Tmax

The SACE Tmax VF family of circuit-breakers can be fitted with the following electrical and mechanical accessories, which are already available for the standard family of circuit-breakers for alternating current 50/60Hz applications.

	Draw out	Fixed
Fixed Part FP (UL FILE: E116596)	■	
Kit for conversion into moving part of draw out (UL FILE: E116596)	■	
Insulating terminal covers	■	■
Phase separators	■	■
Screws for sealing the terminal covers	■	■
Shunt opening release – SOR (UL FILE: E116596) ⁽¹⁾	■	■
Shunt opening release with permanent service – PS-SOR ⁽¹⁾	■	■
SOR test unit	■	■
Undervoltage release – UVR (UL FILE: E116596) ⁽¹⁾	■	■
Time delay device for undervoltage release – UVD	■	■
Testing extension for service releases	■	
Auxiliary contacts for signaling circuit-breaker open/closed and release tripped - AUX	■	■
Auxiliary contacts for signaling trip coil release trip - AUX-SA ⁽²⁾	■	■
Auxiliary contacts for signaling manual/remote operation - AUX-MO	■	■
Testing extension for auxiliary contacts	■	
Early auxiliary contacts – AUE	■	■
Auxiliary position contacts – AUP	■	
Stored energy motor operator – MOE (UL FILE: E116596) ⁽³⁾	■	■
Testing extension for motor operators	■	
Adapters – ADP	■	
Socket plug connectors	■	
Rotary handle operating mechanism – RHD/RHE (UL FILE: E116596)	■	■
IP54 protection for rotary handle (UL FILE: E116596)	■	■
Front for lever operating mechanism – FLD (UL FILE: E116596)	■	■
Key lock – KLF-D and KLF-S	■	■
Lock in the racked-out position for cradle	■	
Mechanical interlock (UL FILE: E116596)	■	■

⁽¹⁾ Electrical life 2.500 operations;

⁽²⁾ Available only for automatic circuit-breaker with PR222/VF;

⁽³⁾ Electrical life 10.000 operations.

For further information on the accessories, please consult Tmax catalogue low voltage moulded-case circuit-breakers.

Accessories

Connection terminals: Tmax

The SACE Tmax VF family of circuit-breakers can be fitted with the following terminals, which are already available for the standard family of circuit-breakers for alternating current 50/60Hz applications.

	Circuit-breaker	Fixed part
Front terminals for CuAl cables - FcCuAl 3*185 ⁽¹⁾	■	
Rear terminals vertical - VR	■	
Rear terminals horizontal - HR	■	
Front terminals - F	■	
Rear flat vertical terminals - VR ⁽¹⁾		■
Rear flat horizontal terminals - HR ⁽¹⁾		■
Front extended terminals - EF ⁽¹⁾		■

⁽¹⁾ UL listed

For further information on the accessories, please consult Tmax catalogue low voltage moulded-case circuit-breakers.

Accessories

Electrical and mechanical accessories: Emax

The SACE Emax VF family of circuit-breakers can be fitted with the following electrical and mechanical accessories, which are already available for the standard family of circuit-breakers for alternating current 50/60Hz applications.

	Draw out	Fixed
1a) Shunt opening/closing release (YO/YC) and second shunt opening release (YO2)	■	■
1b) SOR test unit	■	■
2a) Undervoltage release (YU) ⁽⁴⁾	■	■
2b) Time-delay device for undervoltage release (D)	■	■
3) Gearmotor for the automatic charging of the closing springs (M)		■
4a) Electrical signalling of electronic release tripped ⁽³⁾	■	■
4b) Electrical signalling of electronic release tripped with remote reset command ⁽⁶⁾	■	■
5a) Electrical signaling of circuit-breaker open/closed ^{(1) (5)}	■	■
5b) External supplementary electrical signaling of circuit-breaker open/closed	■	■
5c) Electrical signaling of circuit-breaker racked-in/test isolated/racked-out	■	
5d) Contact signaling closing springs charged	■	■
5e) Contact signaling undervoltage release de-energized (C. Aux YU)	■	■
7) Mechanical operation counter	■	■
8a) Lock in open position: key	■	■
8b) Lock in open position: padlocks	■	■
8c) Circuit-breaker lock in racked-in/test isolated/racked-out position	■	
8d) Accessories for lock in test isolated/racked-out position	■	
8e) Padlock device for safety shutter	■	
8f) Mechanical lock for compartment door	■	■
8g) Anti-racking-out device when the springs are charged (FAIL SAFE) ⁽²⁾	■	
9a) Protection for opening and closing pushbuttons	■	■
9b) IP54 door protection	■	■
10) Mechanical interlock	■	■
11) Lift device	■	■

⁽¹⁾ Four auxiliary contacts are included as standard in the automatic circuit-breaker;

⁽²⁾ Supplied as standard in withdrawable versions of High frequency/UL and Switch disconnector/UL; in alternative with YU. Incompatible with Low frequency versions;

⁽³⁾ Available only for automatic circuit-breaker;

⁽⁴⁾ In alternative with anti-racking-out device;

⁽⁵⁾ 10 open/closed contacts are in alternative with PR120/K.

For further information on the accessories, please consult Emax catalogue low voltage air circuit-breakers.



Overall dimensions

Content

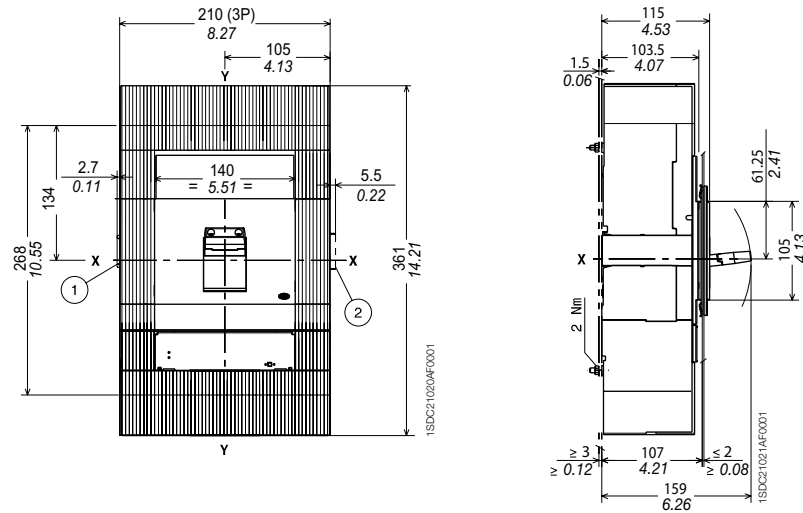
Tmax T6	6/2
Accessories for Tmax T6	6/8
Distances to be respected for Tmax T6	6/13
Emax for low frequency applications	6/14
Emax for high frequency applications and switch disconnecter	6/20
Accessories for Emax	6/33
Installation in switchboard for Emax	6/36

Overall dimensions

Tmax T6

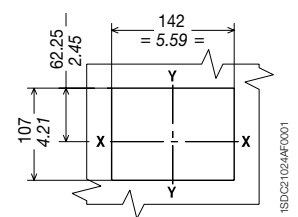
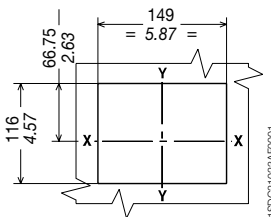
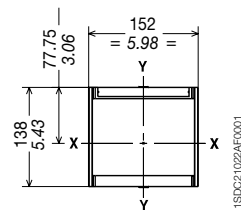
Fixed circuit-breaker

Fixing on sheet



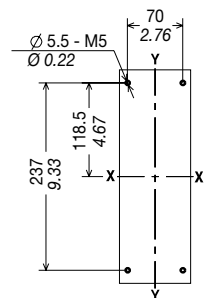
Flange for the compartment door

Drilling templates of the compartment door



Drilling templates for support sheet

For front terminals F, FC CuAl



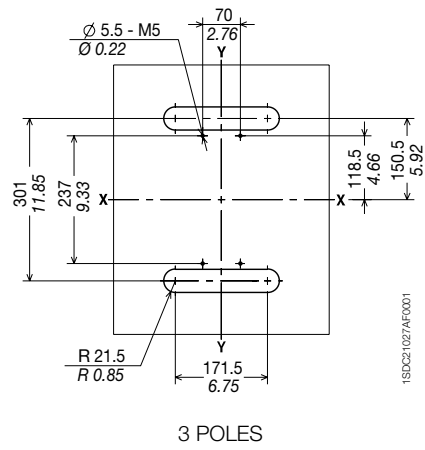
Caption

- ① Overall dimensions with cabled accessories mounted (SOR-C, UVR-C)
- ② Overall dimensions with cabled auxiliary contacts mounted (only 3Q 1SY)

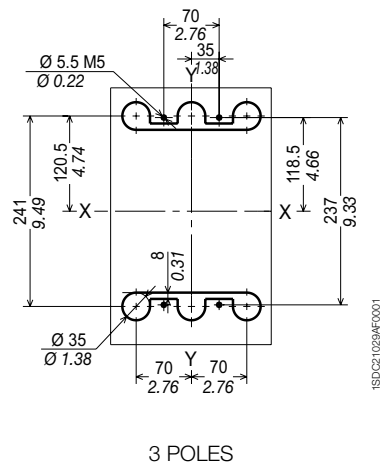
3 POLES

Drilling templates for support sheet

For rear terminals for Cu/Al cables



For rear terminals - R

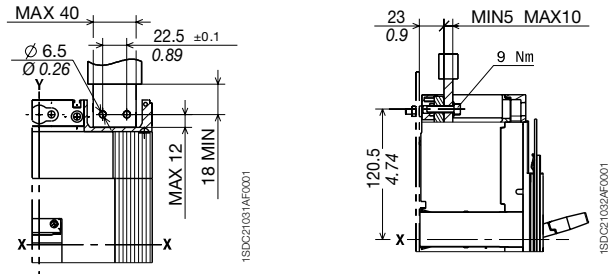


Overall dimensions

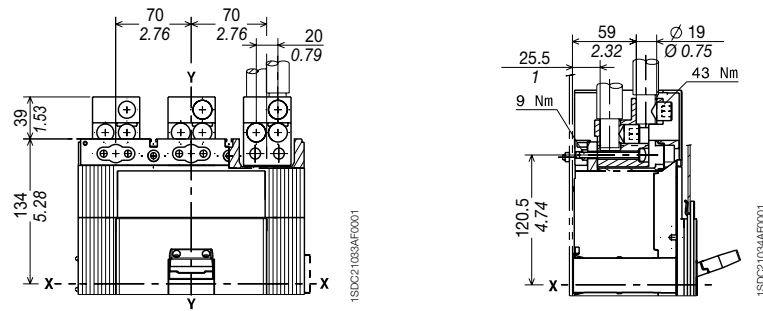
Tmax T6

Terminals

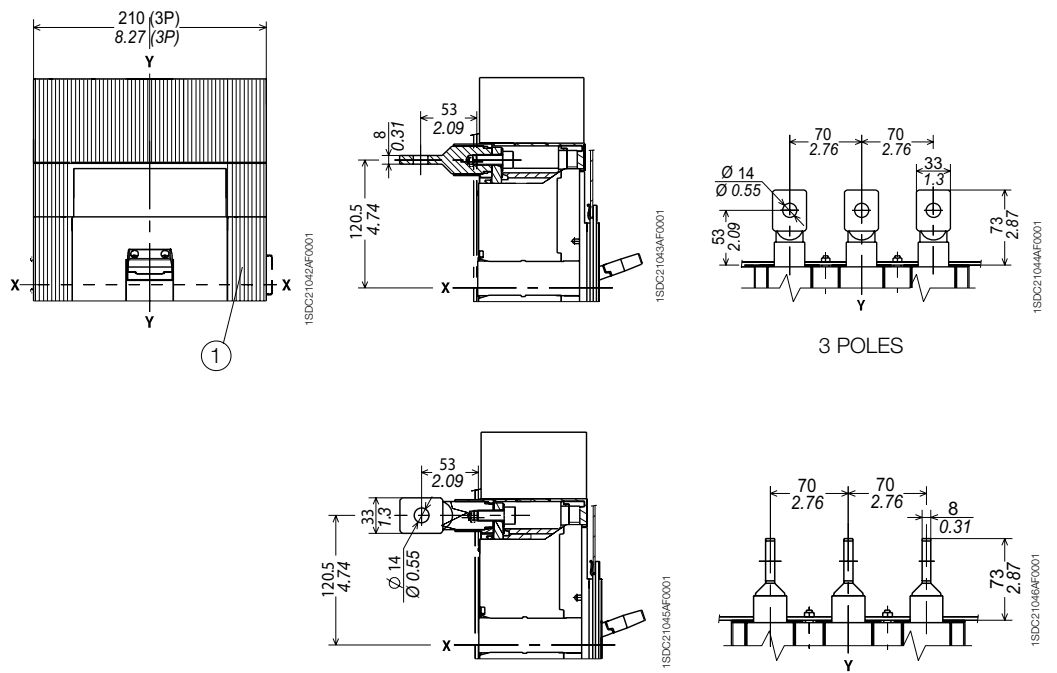
Front - F



Front for copper/aluminium cables Cu/Al 3x185 mm² FC CuAl



Rear - R



Caption

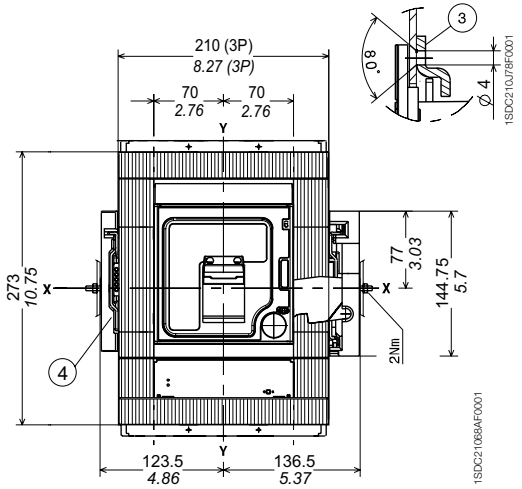
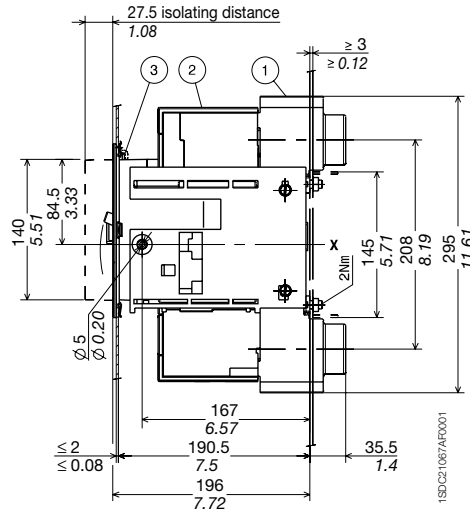
- ① Low terminal covers with degree of protection IP40

Overall dimensions

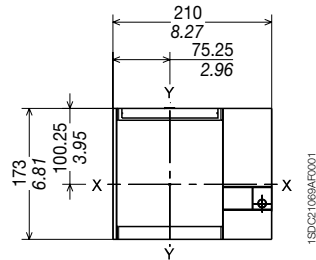
Tmax T6

Draw out circuit-breaker

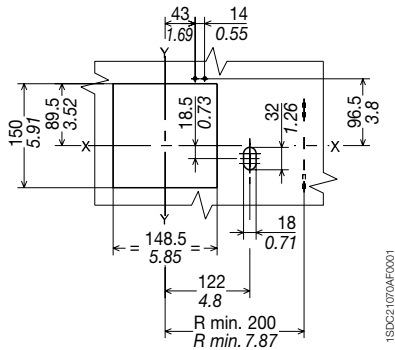
Fixing on sheet



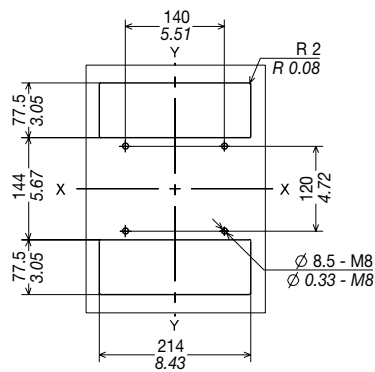
Flange for the compartment door



Drilling templates of the compartment door



Drilling templates for support sheet

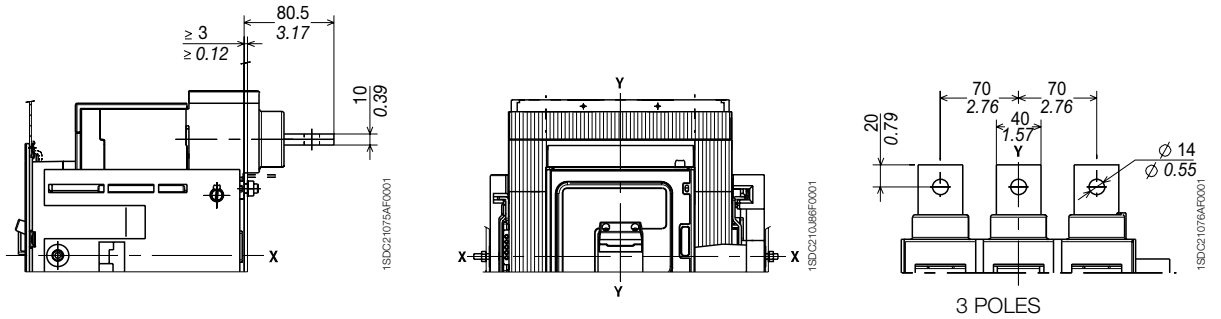


Caption

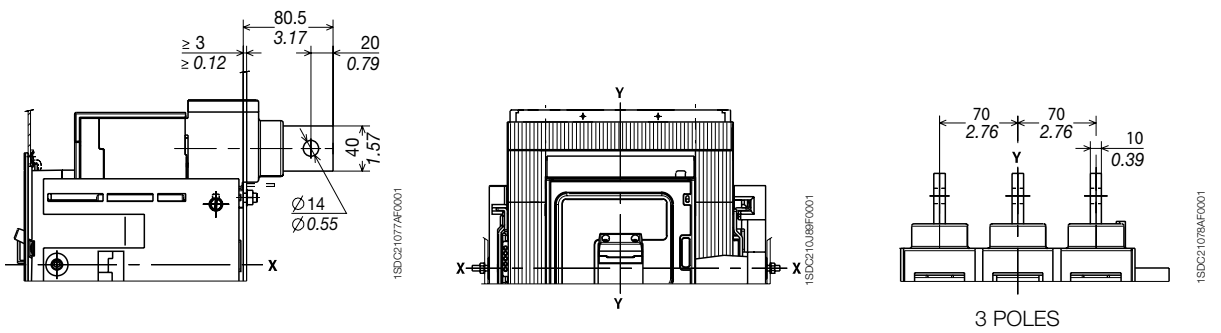
- ① Cradle
- ② Moving part
- ③ Lock for compartment (available on request)
- ④ Overall dimensions with cabled accessories mounted (SOR-C, UVR-C)

Terminals

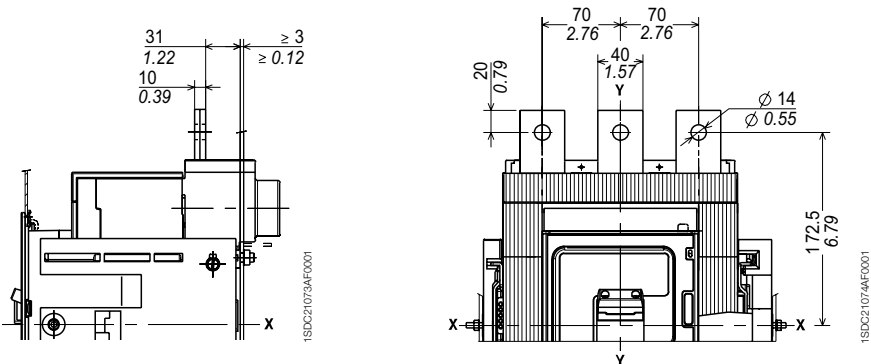
Rear flat horizontal - HR



Rear flat vertical - VR



Front extended - EF



Overall dimensions

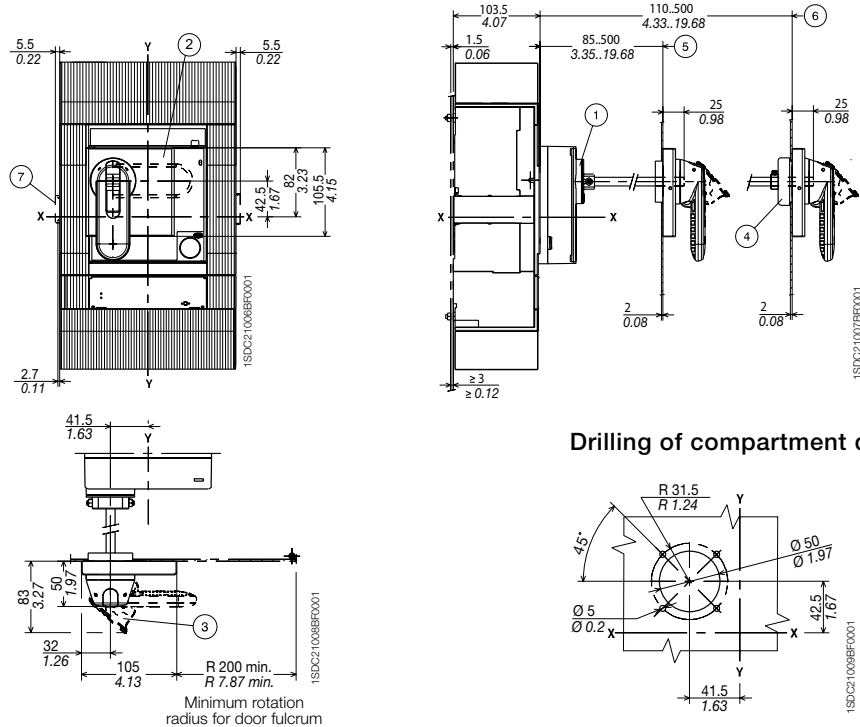
Accessories for Tmax T6

Fixed version

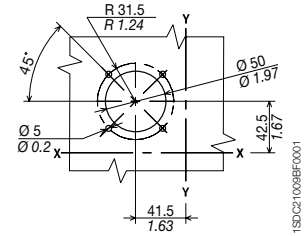
Rotary handle operating mechanism on the compartment door

Caption

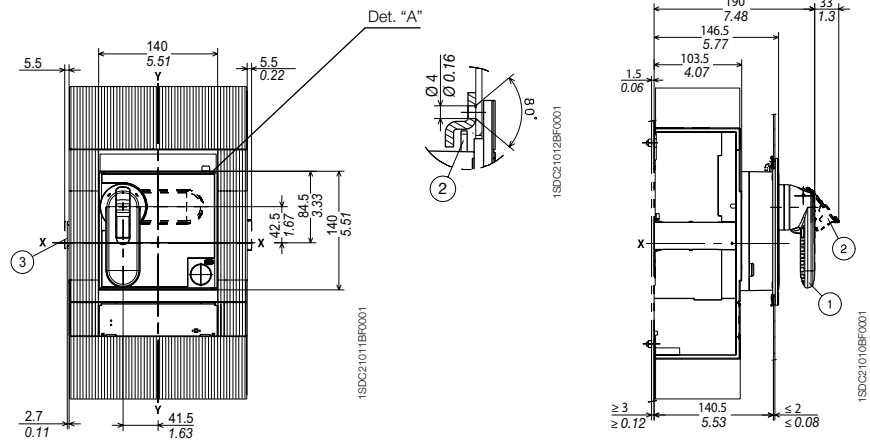
- ① Transmission unit
- ② Rotary handle assembly with door lock device
- ③ Padlock device for open position (maximum 3 padlocks to be provided by the user)
- ④ IP54 protection (supplied on request)
- ⑤ Min...max distance from the front of the door without accessory ④
- ⑥ Min...max distance from the front of the door with accessory ④
- ⑦ Dimension with AUE connector (early making contact)



Drilling of compartment door



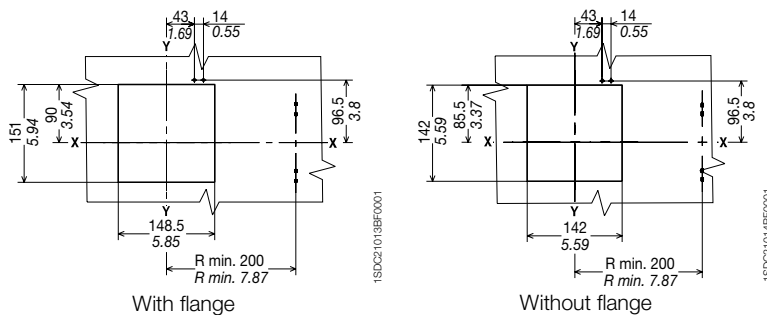
Rotary handle operating mechanism on circuit-breaker



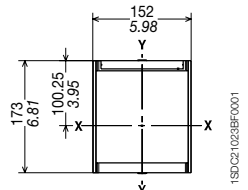
Caption

- ① Rotary handle operating mechanism on circuit-breaker
- ② Padlock device for open position (maximum 3 padlocks to be provided by the user)
- ③ Dimension with AUE connector (early making contact)
- ④ Compartment door lock

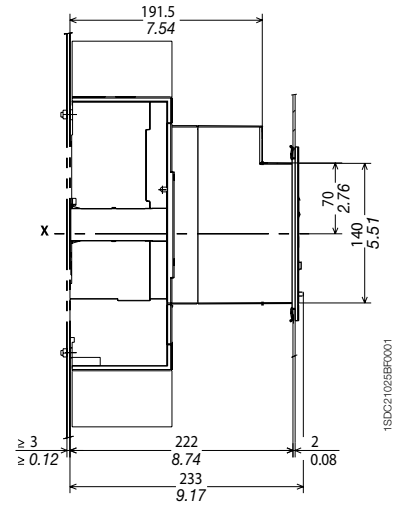
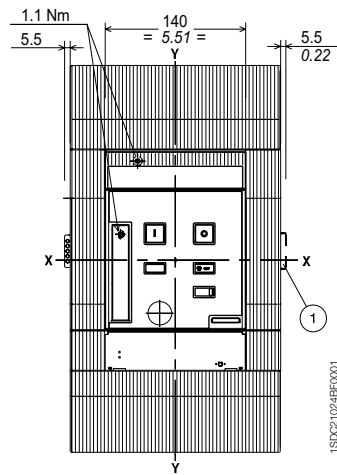
Drilling template of the compartment door



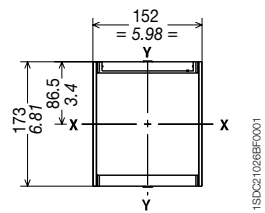
Flange for the compartment door



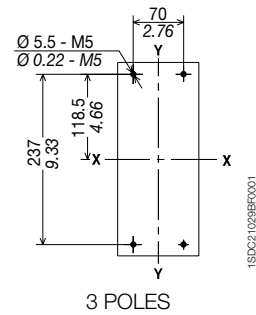
Motor operator



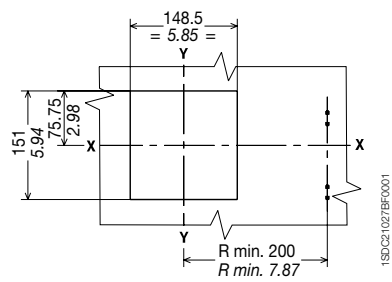
Flange for the compartment door (supplied as standard)



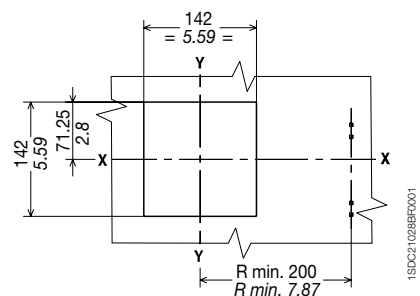
Drilling template for support sheet



Drilling template of the compartment door



With flange



Without flange

Caption

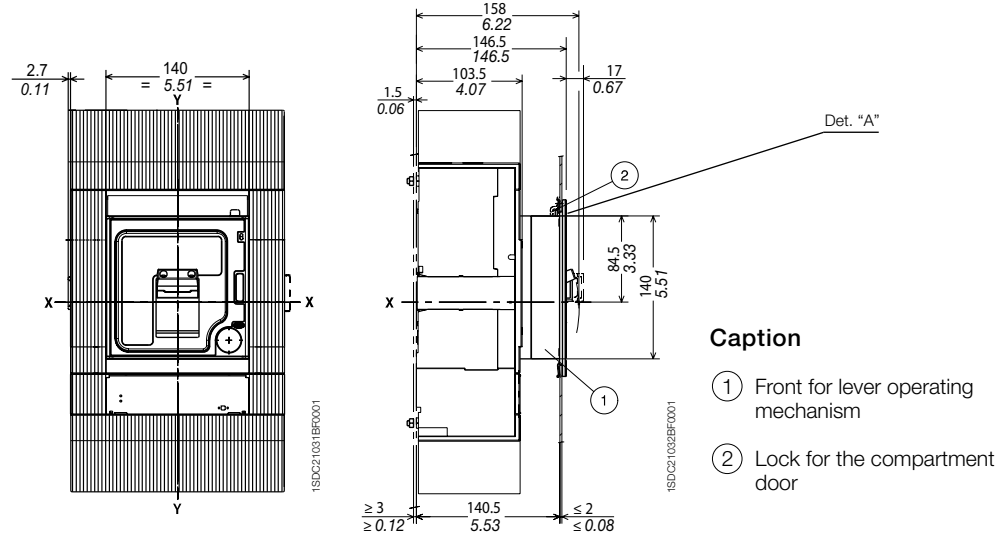
- ① Overall dimensions with cabled auxiliary contacts mounted (only 3Q 1SY)

Overall dimensions

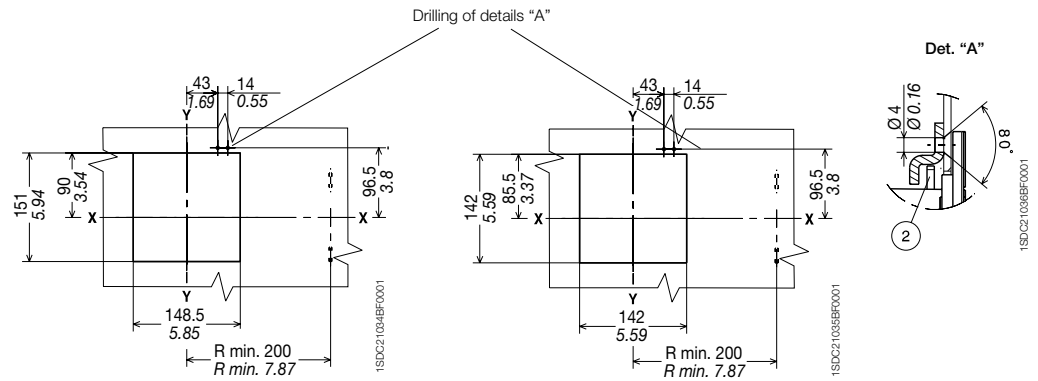
Accessories for Tmax T6

Fixed version

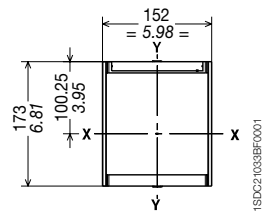
Front for lever operating mechanism



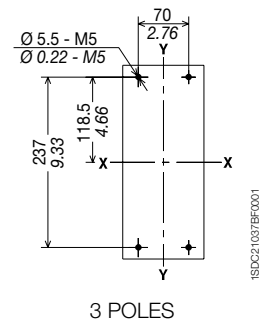
Drilling template for the compartment door



Flange for the compartment door (supplied as standard)

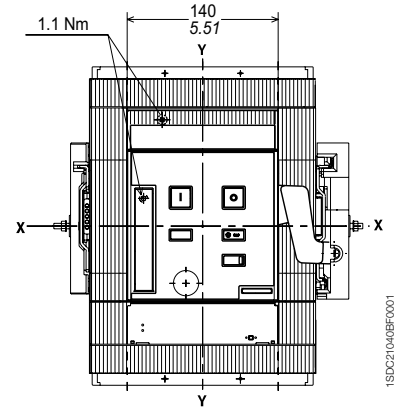
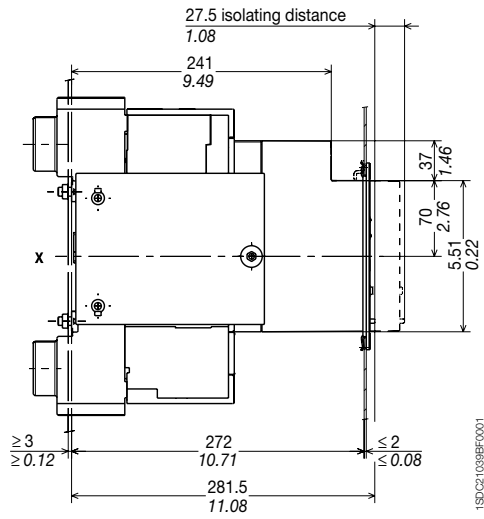


Drilling template for support sheet

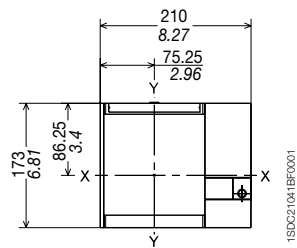


Draw out version

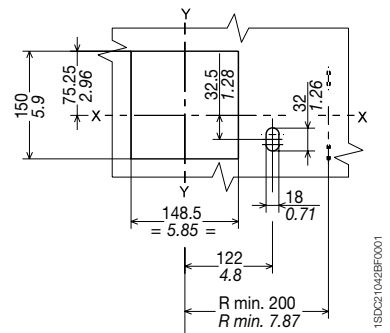
Motor operator



Flange for the compartment door (supplied as standard)



Drilling templates for the compartment door and fitting flange

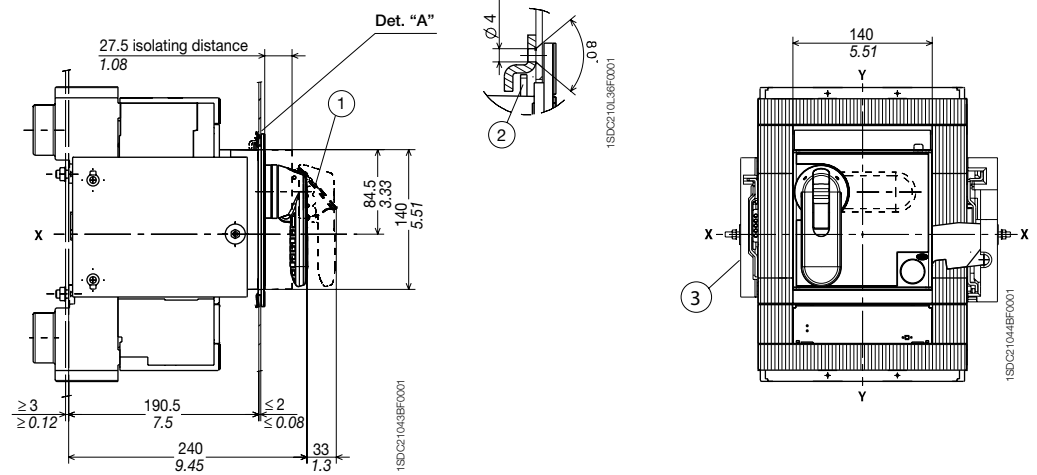


Overall dimensions

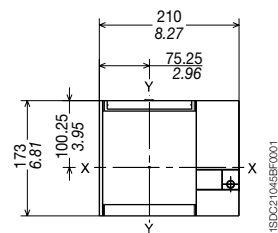
Accessories for Tmax T6

Draw out version

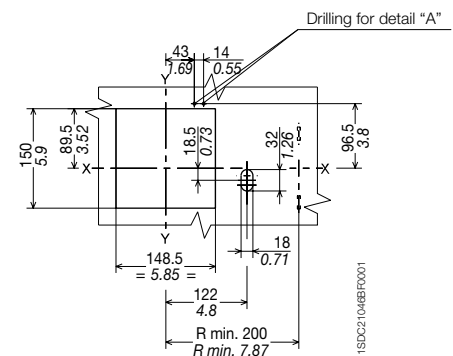
Rotary handle operating mechanism on the circuit-breakers



Flange for the compartment door



Drilling template for compartment door and fitting flange



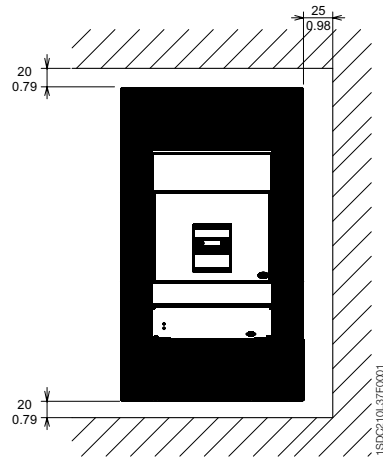
Caption

- ① Padlock device for open position (maximum 3 padlocks to be provided by the user)
- ② Lock for compartment door
- ③ Dimension with AUE connector (early making contact)
- ④ Interlocking mechanism
- ⑤ Circuit-breaker coupling plate
- ⑥ Drilling template for all versions of terminals

Overall dimensions

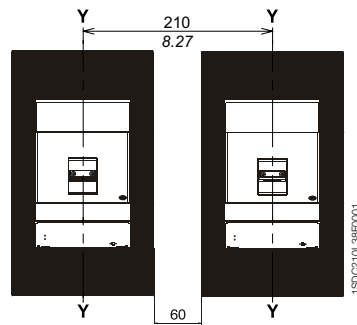
Distances to be respected for Tmax T6

Insulation distances for installation in metallic cubicle



Minimum centre distance between two circuit-breakers side by side or superimposed
For assembly side by side or superimposed, check that the connection busbars or cables do not reduce the air insulation distance

Minimum centre distance for two circuit-breakers side by side

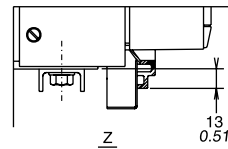
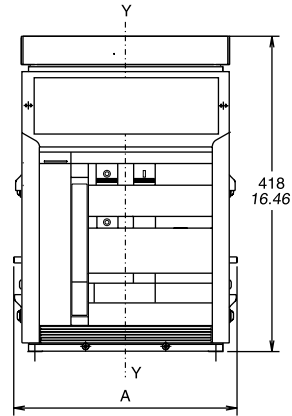


Overall dimensions

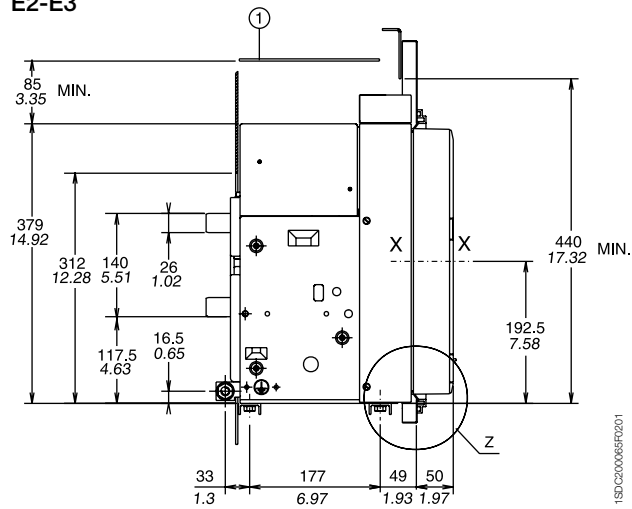
Emax for low frequency applications

Fixed circuit-breakers

Basic version with horizontal rear terminals



E2-E3

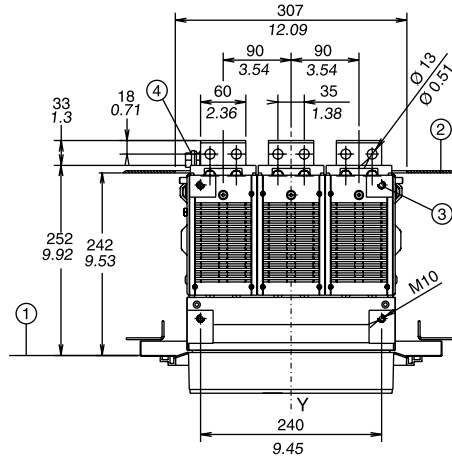


	A 3 Poles
E2	296/11.65"
E3	404/15.91"

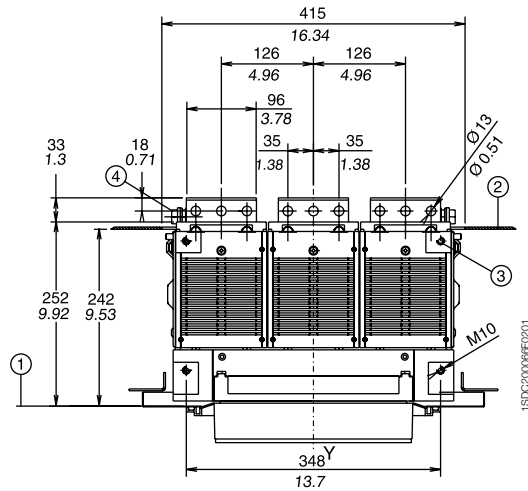
Caption

- ① Insulating wall or insulated metal wall

E2 3 poles



E3 3 poles



Caption

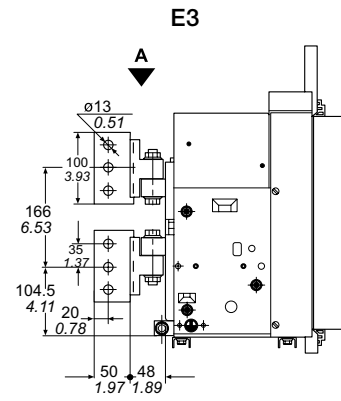
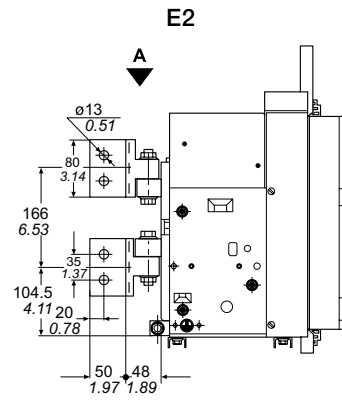
- ① Inside edge of compartment door
- ② Segregation (when provided)
- ③ M10 mounting holes for circuit-breaker (included in the supply)
- ④ 1x M12 screw for earthing (included in the supply)

Overall dimensions

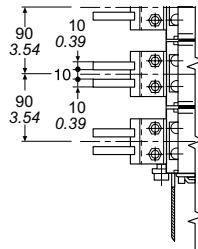
Emax for low frequency applications

Fixed circuit-breakers

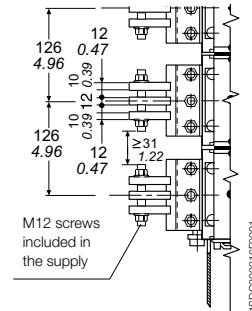
Basic version with vertical rear terminals



E2
View A

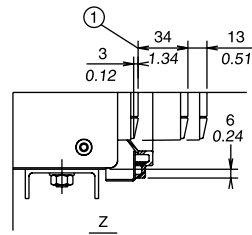
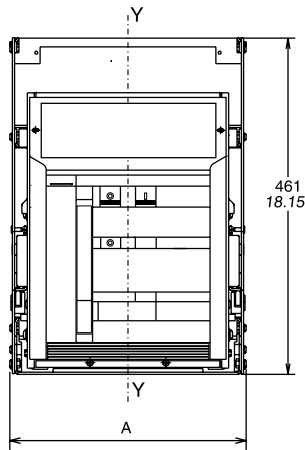


E3
View A

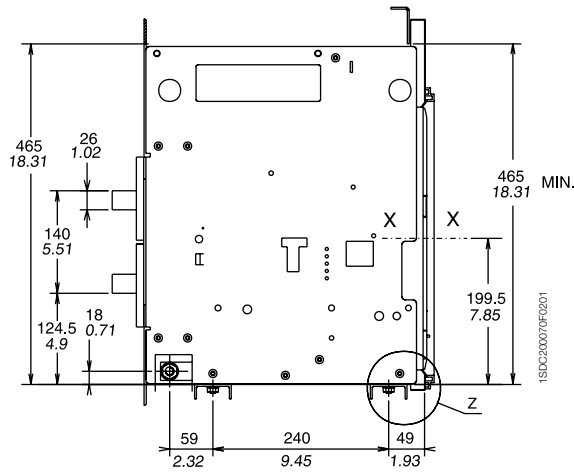


Draw out circuit-breaker

Basic version with horizontal rear terminals



E2-E3



	A 3 Poles
E2	324/12.76"
E3	432/17.01"

Caption

① Distance from connected for testing to isolated

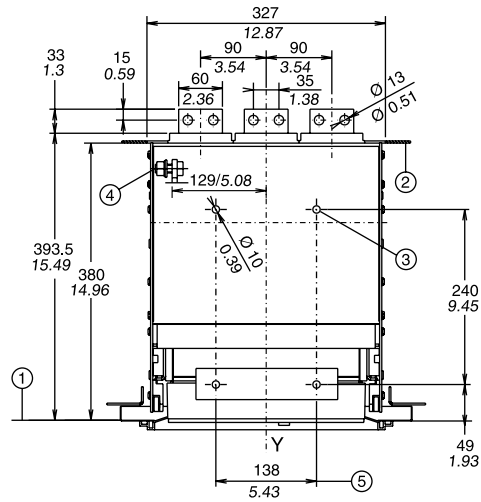
Overall dimensions

Emax for low frequency applications

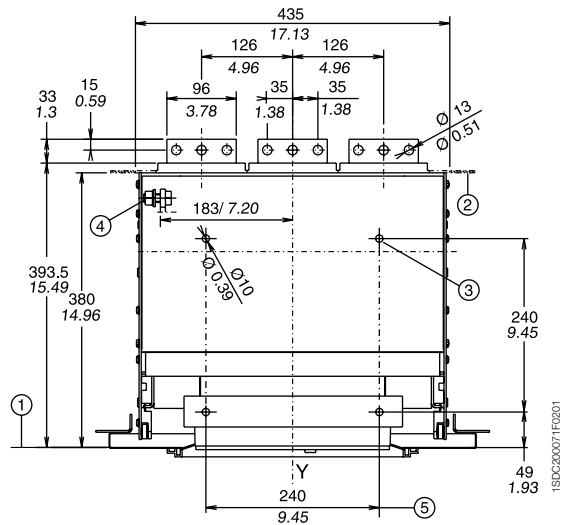
Draw out circuit-breaker

Basic version with horizontal rear terminals

E2 3 poles



E3 3 poles

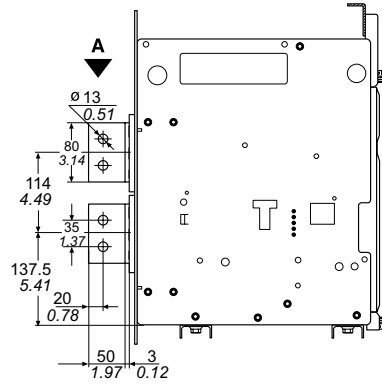


Caption

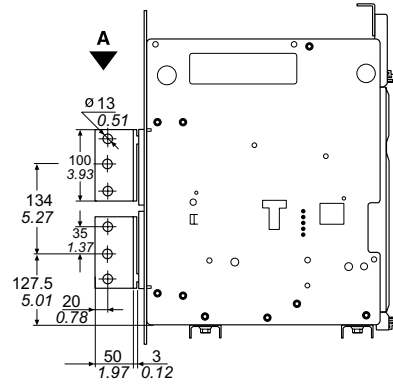
- ① Inside edge of compartment door
- ② Segregation (when provided)
- ③ M8 mounting holes for circuit-breaker (included in the supply)
- ④ 1x M12 screws for earthing (included in the supply)
- ⑤ 4 holes for mounting fixed part (standard)

Basic version with vertical rear terminals

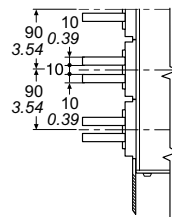
E2



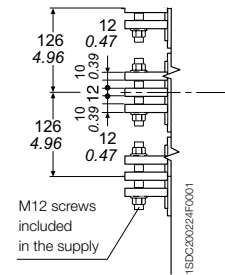
E3



E2
View A



E3
View A

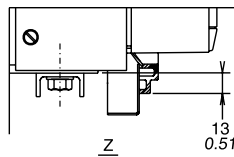
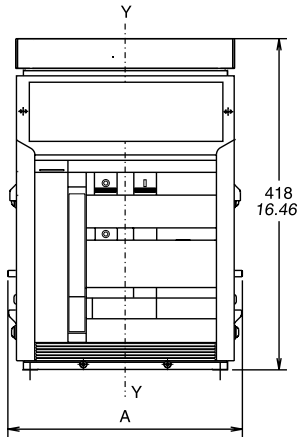


Overall dimensions

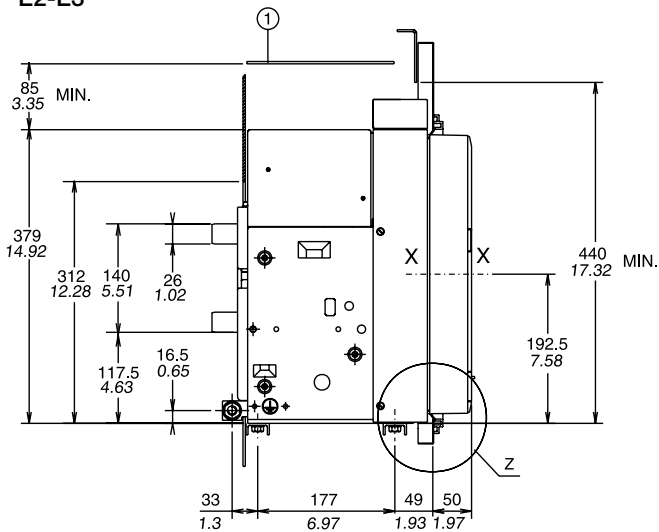
Emax for high frequency applications
and switch disconnecter

Fixed circuit-breaker

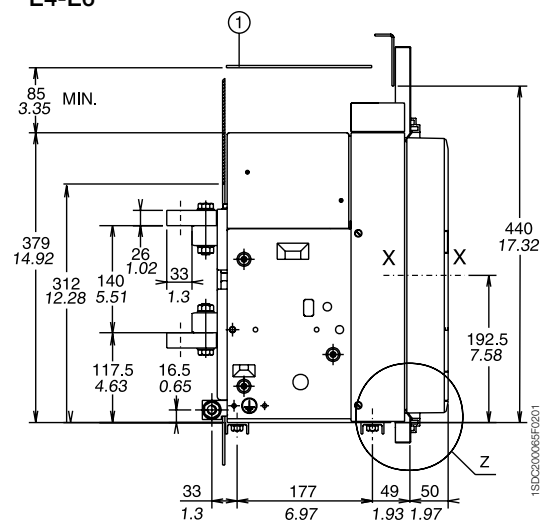
Basic version with horizontal rear terminals



E2-E3



E4-E6

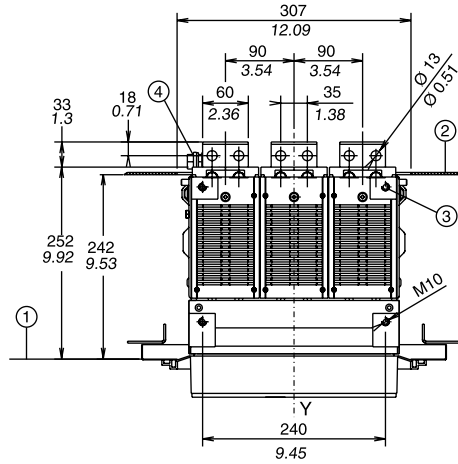


	A
	3 Poles
E2	296/11.65"
E3	404/15.91"
E4	566/22.28"
E6	782/30.79"

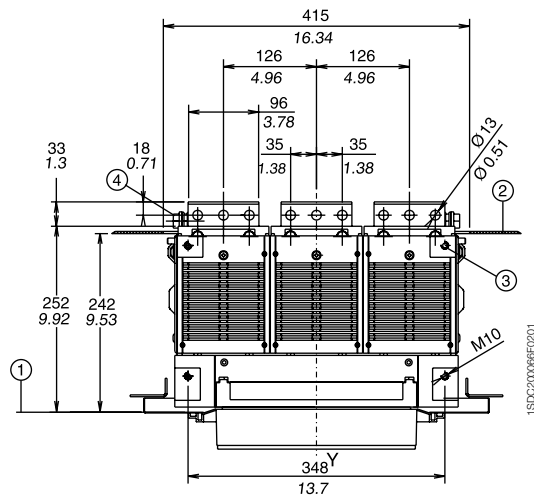
Caption

- ① Insulating wall or insulated metal wall

E2 3 poles



E3 3 poles



Caption

- ① Inside edge of compartment door
- ② Segregation (when provided)
- ③ M10 mounting holes for circuit-breaker (included in the supply)
- ④ 1x M12 screw for earthing (included in the supply)

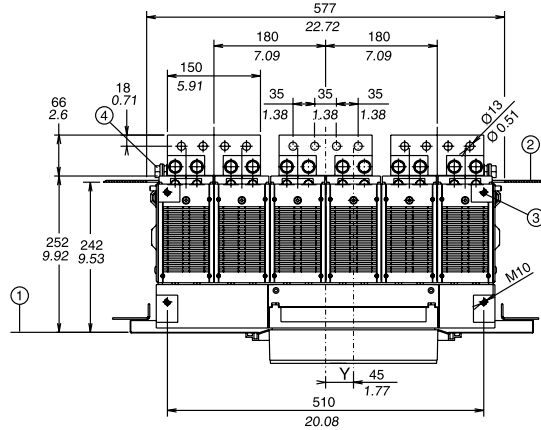
Overall dimensions

Emax for high frequency applications
and switch disconnecter

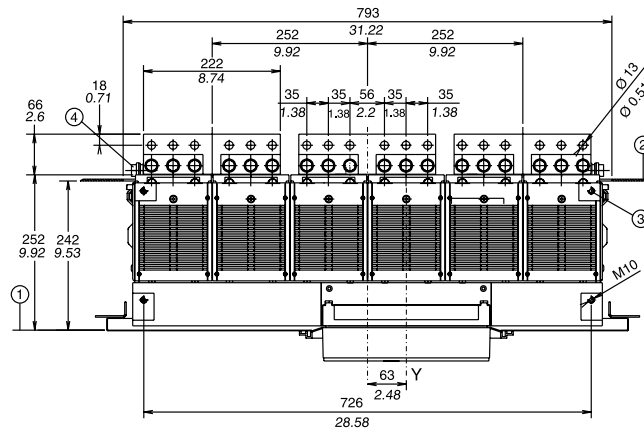
Fixed circuit-breaker

Basic version with horizontal rear terminals

E4 3 poles



E6 3 poles



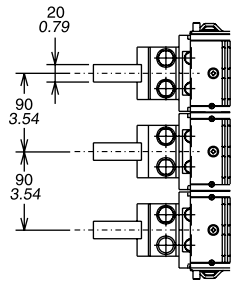
1SDC00067FD01

Caption

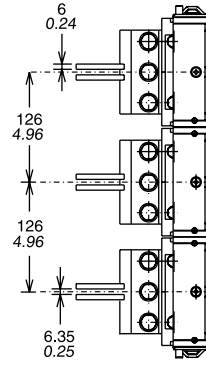
- ① Inside edge of compartment door
- ② Segregation (when provided)
- ③ M10 mounting holes for circuit-breaker (included in the supply)
- ④ 1x M12 screw for earthing (included in the supply)

Basic version with vertical rear terminals

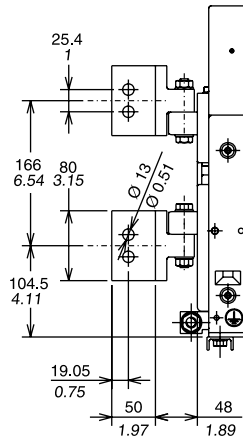
E2



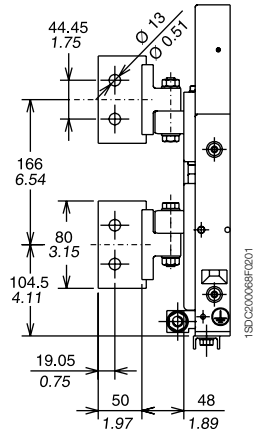
E3 2000 A



E2



E3 2000 A



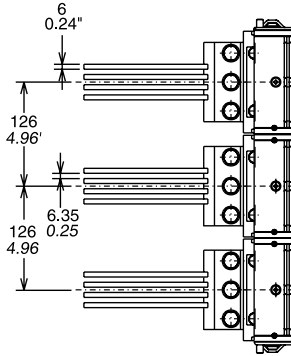
Overall dimensions

Emax for high frequency applications
and switch disconnecter

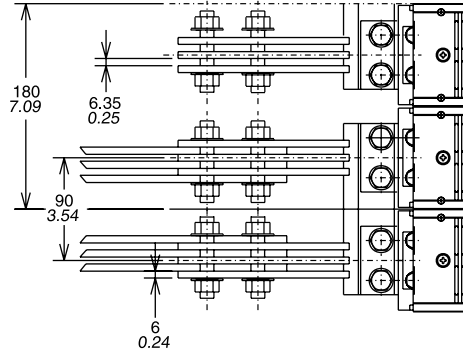
Fixed circuit-breaker

Basic version with vertical rear terminals

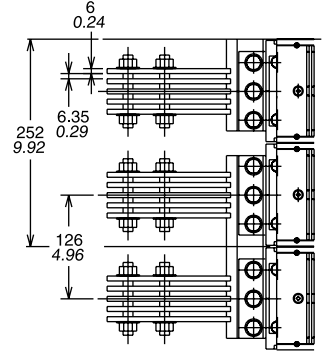
E3 2500 A



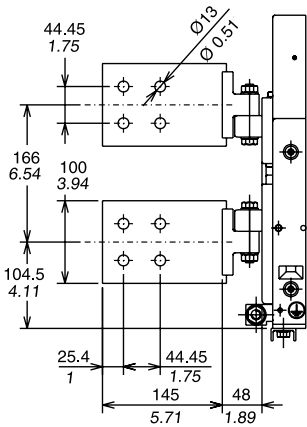
E4



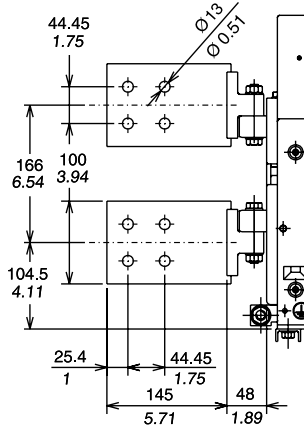
E6



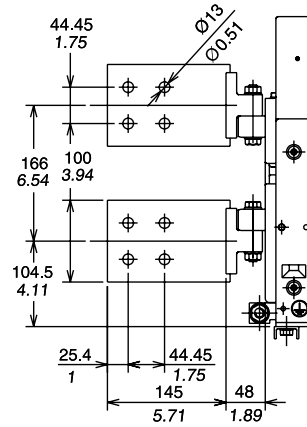
E3 2500 A



E4



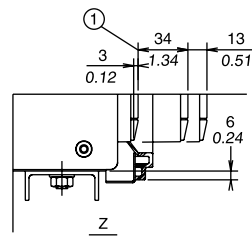
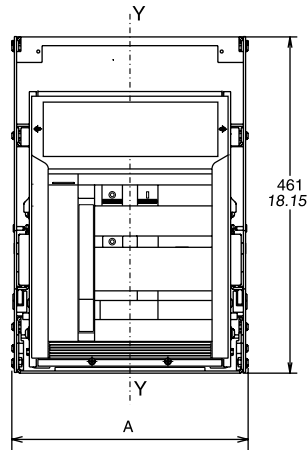
E6



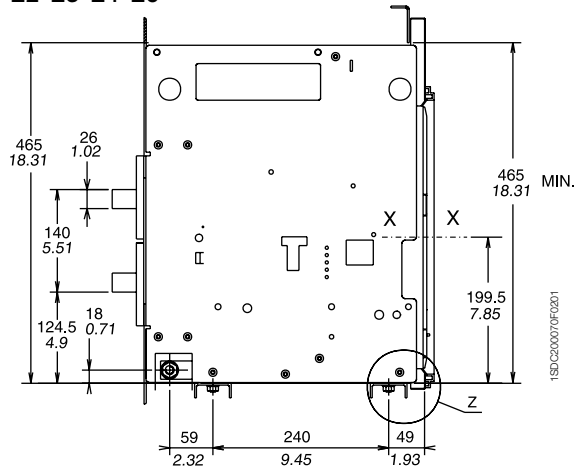
1SDC00069F001

Draw out circuit-breaker

Basic version with horizontal rear terminals



E2-E3-E4-E6



	A
	3 Poles
E2	324/12.76"
E3	432/17.01"
E4	594/23.39"
E6	810/31.89"

Caption

- ① Distance from connected for testing to isolated

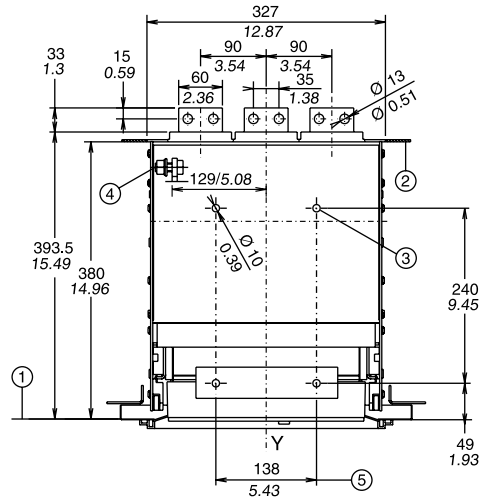
Overall dimensions

Emax for high frequency applications
and switch disconnecter

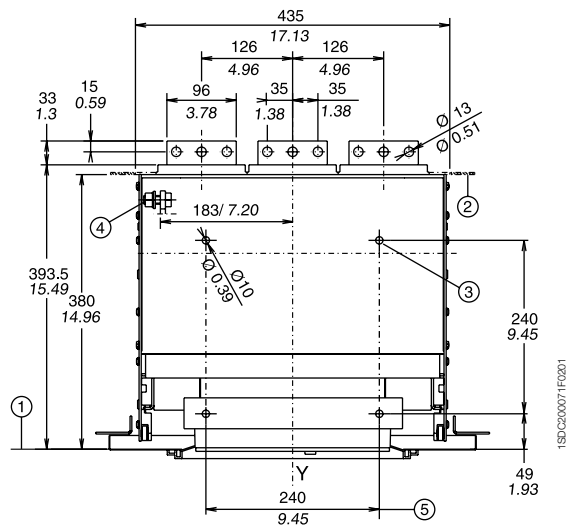
Draw out circuit-breaker

Basic version with horizontal rear terminals

E2 3 poles



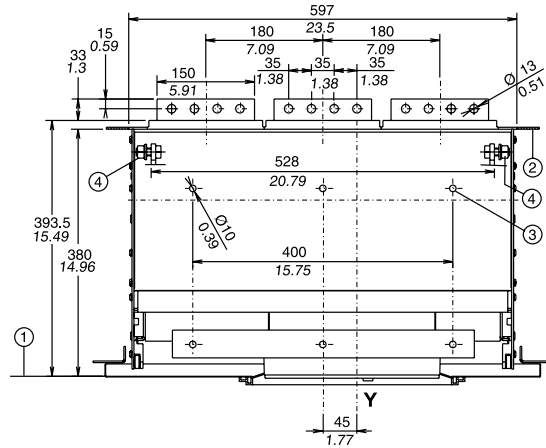
E3 3 poles



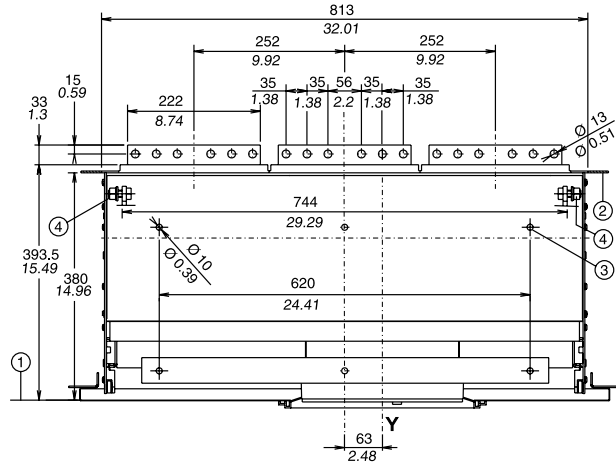
Caption

- ① Inside edge of compartment door
- ② Segregation (when provided)
- ③ M8 mounting holes for circuit-breaker (included in the supply)
- ④ 1x M12 screws for earthing (included in the supply)
- ⑤ 4 holes for mounting fixed part (standard)

E4 3 poles



E6 3 poles



1SDC00072F0201

Caption

- ① Inside edge of compartment door
- ② Segregation (when provided)
- ③ M8 mounting holes for circuit-breaker (included in the supply)
- ④ 1x M12 screw for earthing (included in the supply)

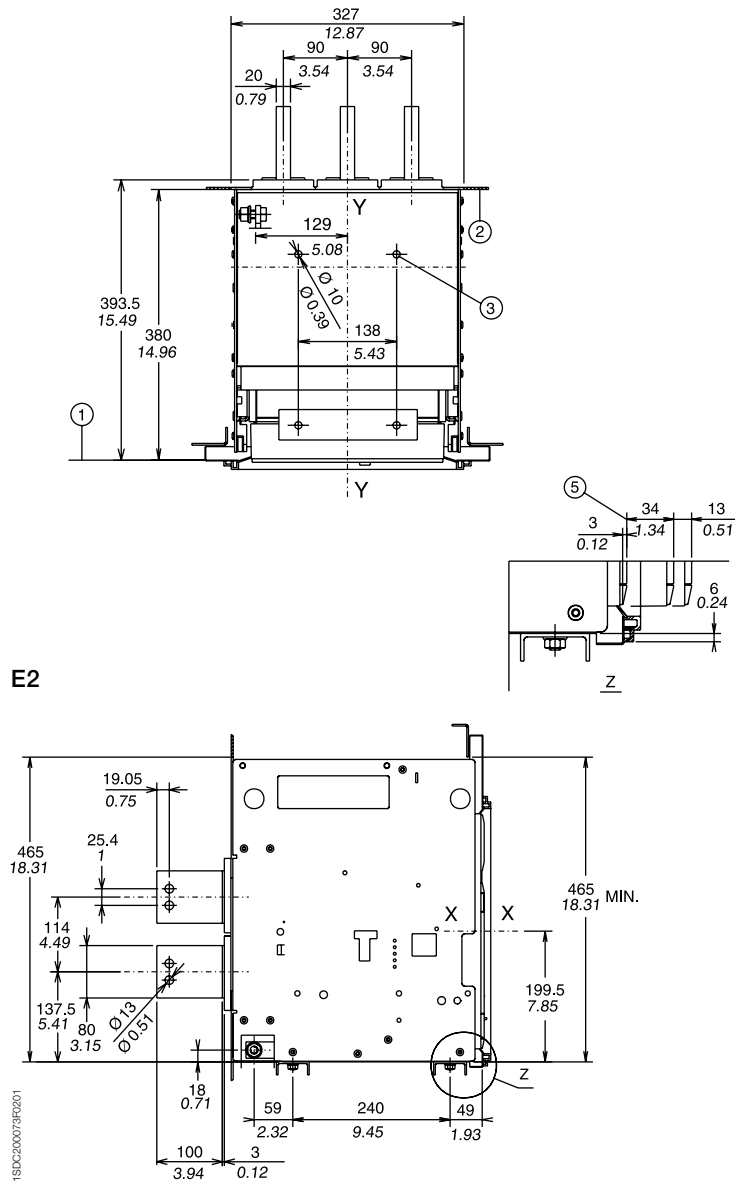
Overall dimensions

Emax for high frequency applications
and switch disconnector

Draw out circuit-breaker

Basic version with vertical rear terminals

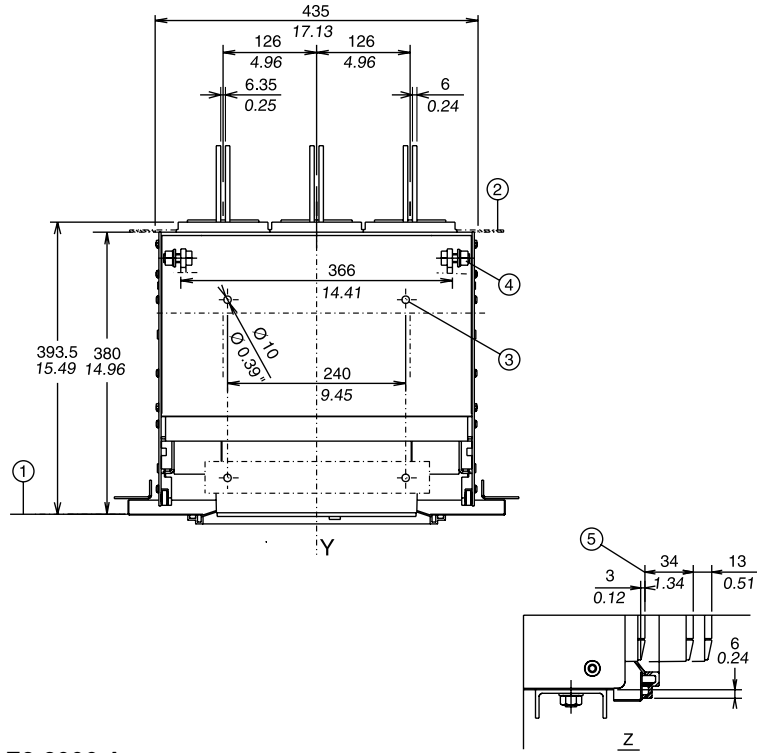
E2 3 poles



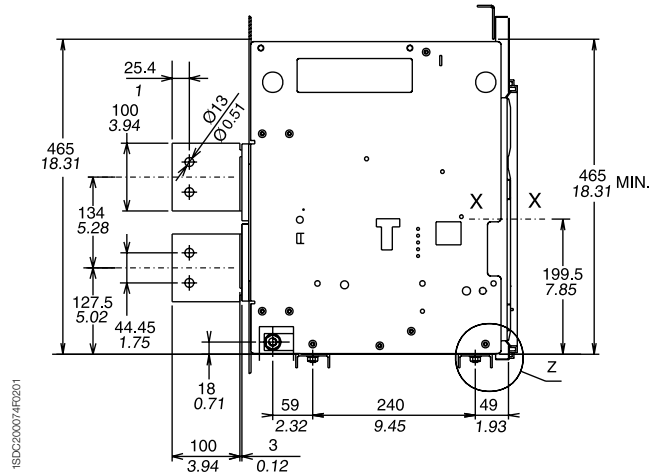
Caption

- ① Inside edge of compartment door
- ② Segregation (when provided)
- ③ M8 mounting holes for circuit-breaker (included in the supply)
- ⑤ Distance from connected for testing to isolated

E3 3 poles 2000 A



E3 2000 A



Caption

- ① Inside edge of compartment door
- ② Segregation (when provided)
- ③ M8 mounting holes for circuit-breaker (included in the supply)
- ④ 2x M12 screws for earthing (included in the supply)
- ⑤ Distance from connected for testing to isolated

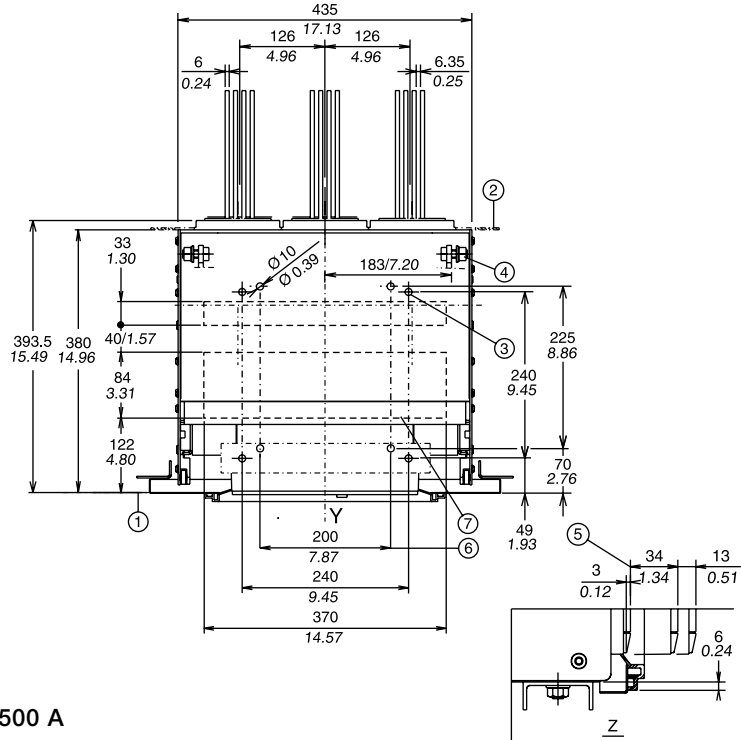
Overall dimensions

Emax for high frequency applications
and switch disconnecter

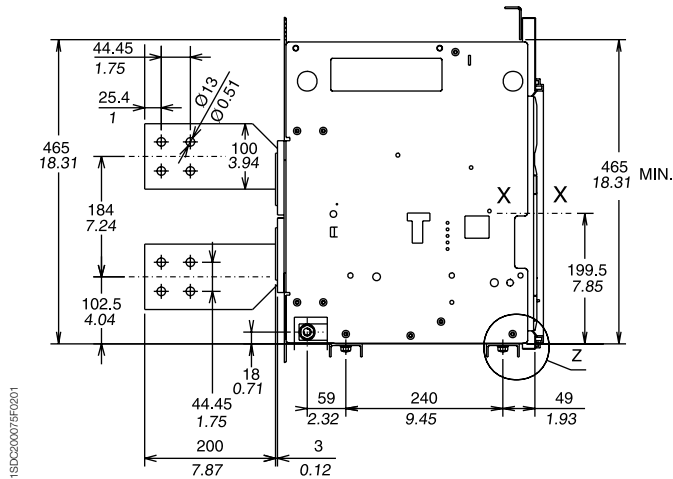
Draw out circuit-breaker

Basic version with vertical rear terminals

E3 3 poles 2500 A



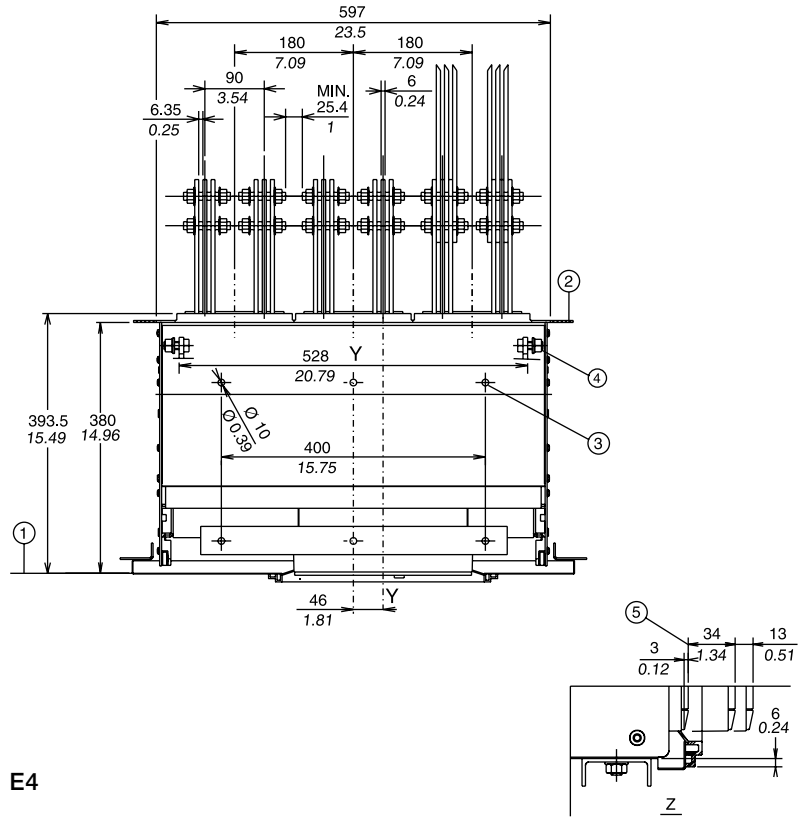
E3 2500 A



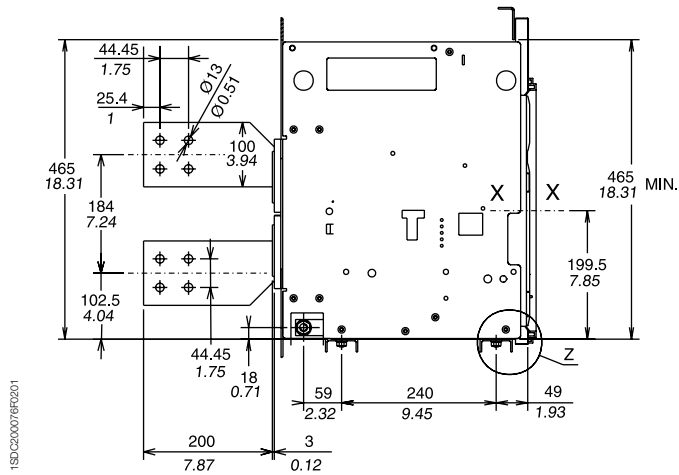
Caption

- ① Inside edge of compartment door
- ② Segregation (when provided)
- ③ M8 mounting holes for circuit-breaker (included in the supply)
- ④ 2x M12 screws for earthing (included in the supply)
- ⑤ Distance from connected for testing to isolated

E4 3 poles



E4



Caption

- ① Inside edge of compartment door
- ② Segregation (when provided)
- ③ M8 mounting holes for circuit-breaker (included in the supply)
- ④ 2x M12 screws for earthing (included in the supply)
- ⑤ Distance from connected for testing to isolated

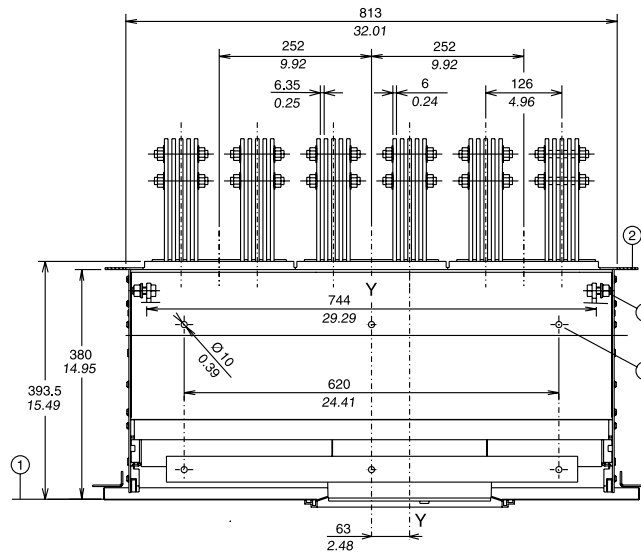
Overall dimensions

Emax for high frequency applications
and switch disconnecter

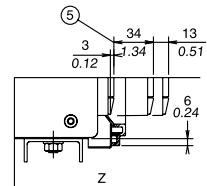
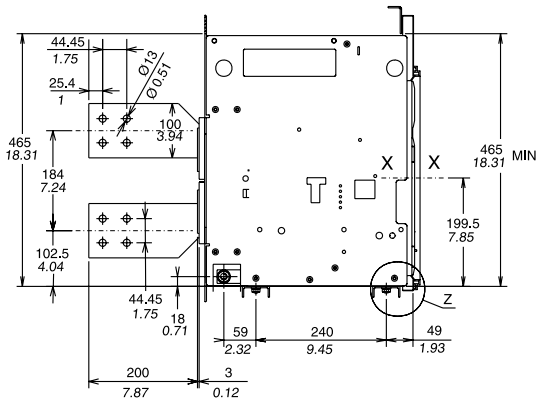
Draw out circuit-breaker

Basic version with vertical rear terminals

E6 3 poles



E6



1SDC0007F0201

Caption

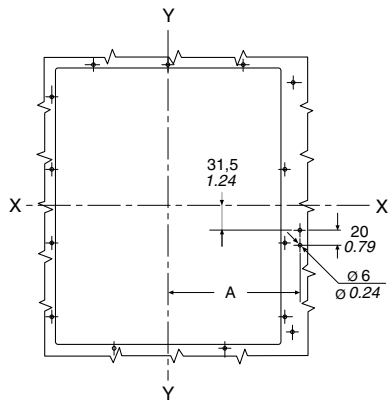
- ① Inside edge of compartment door
- ② Segregation (when provided)
- ③ M8 mounting holes for circuit-breaker (included in the supply)
- ④ 2x M12 screws for earthing (included in the supply)
- ⑤ Distance from connected for testing to isolated

Overall dimensions

Accessories for Emax

Mechanical compartment door lock

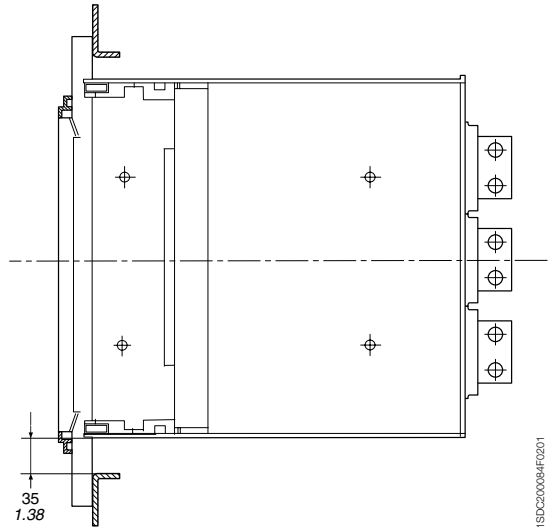
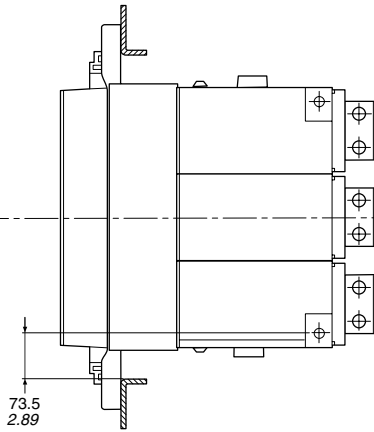
Drilling in compartment door



Minimum distance between circuit-breaker and switchboard wall

Fixed version

Draw out version



	A
	3 Poles
E2	180/7.08"
E3	234/9.21"
E4	270/10.63"
E6	360/14.17"

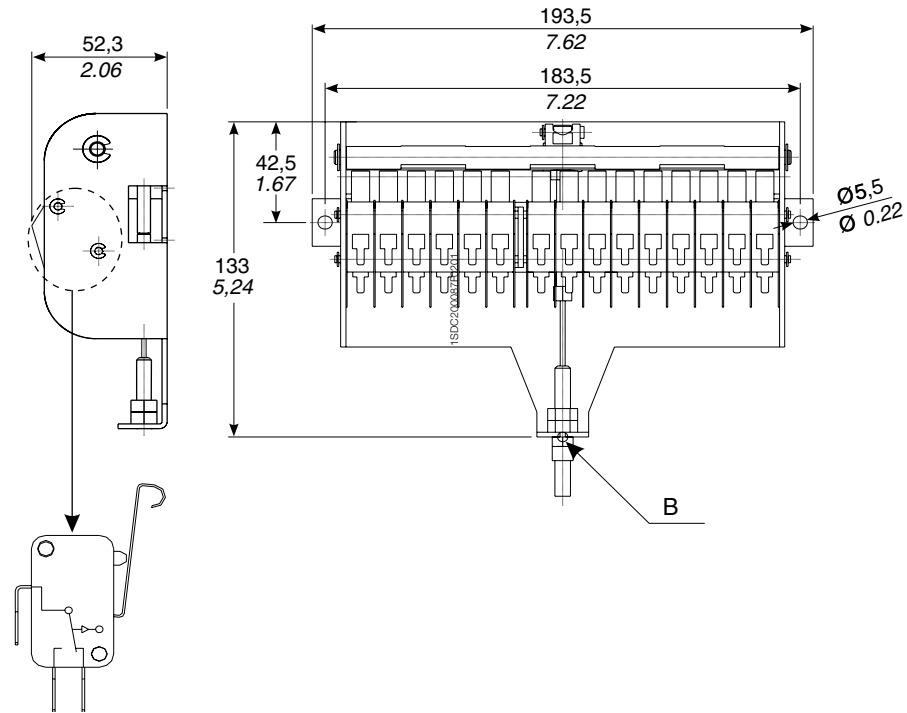
1SDC20084FC201

Overall dimensions

Accessories for Emax

Electrical signaling of circuit-breaker open/closed

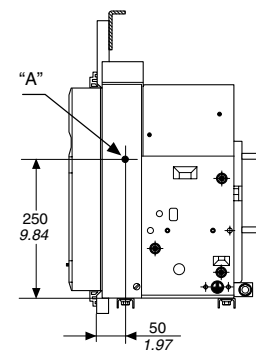
15 supplementary auxiliary contacts



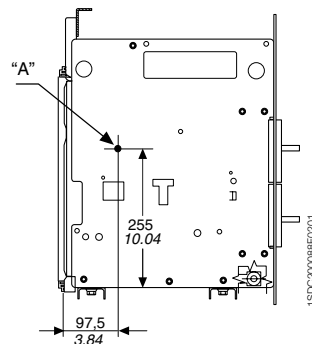
1SDC200091F0201

A flexible cable 650 mm / 25.59 in long is available from point "A" to point "B".

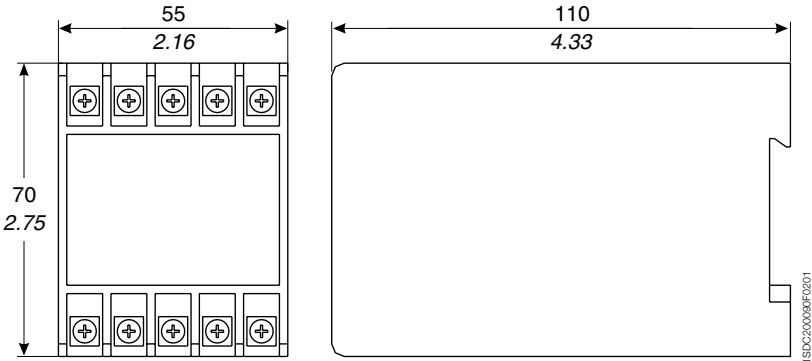
Fixed version



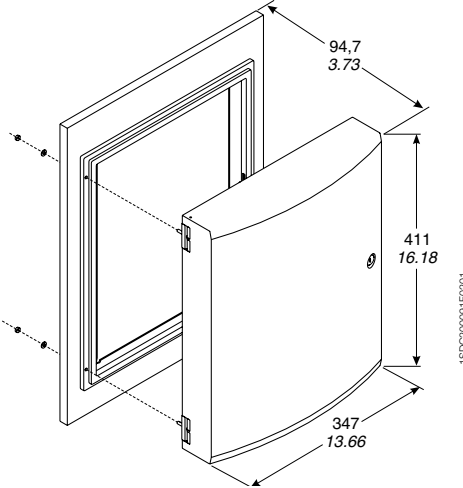
Draw out version



Electronic time-delay device



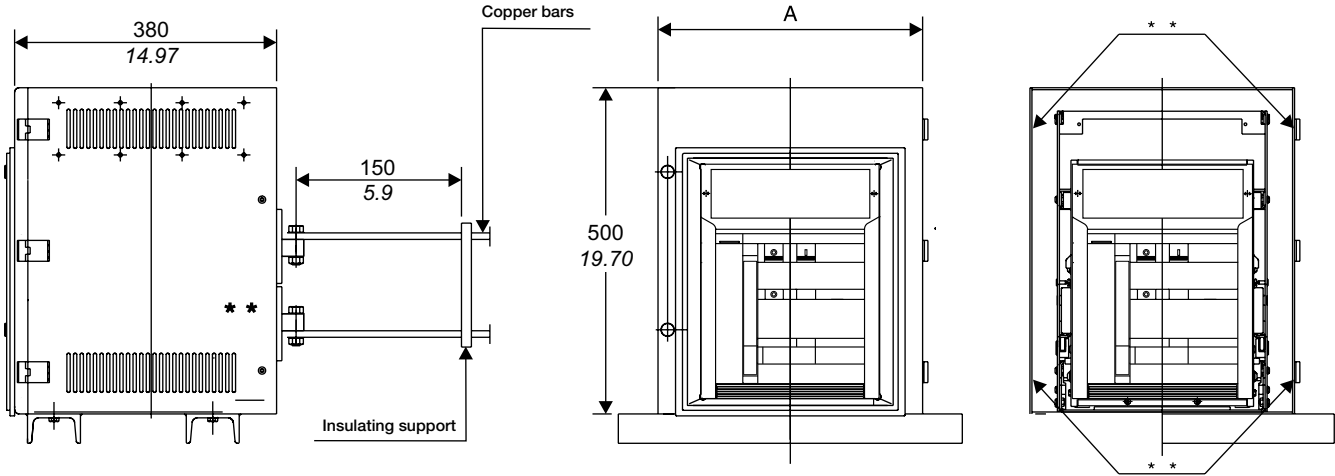
IP54 Protective cover



Overall dimensions

Installation in switchboard for Emax

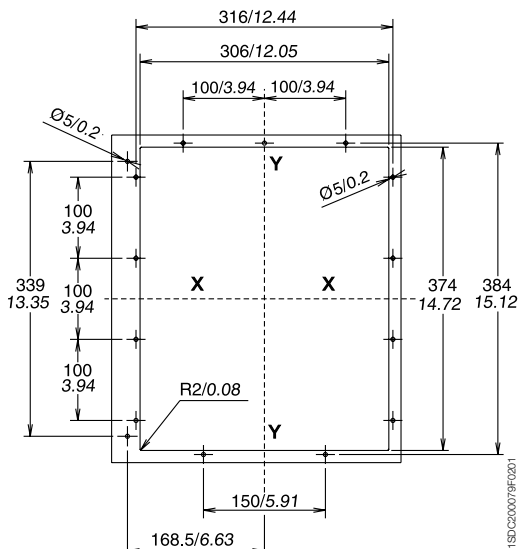
Dimensions of compartment



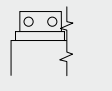
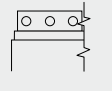
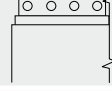
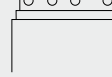
	A
	3 Poles
E2	400/15.76"
E3	500/19.70"
E4	700/27.58"
E6	1000/39.40"

** Suitable for continuous operation at 100% rating in a minimum cubicle space (see the table), with a ventilation of 48 (12x4) sq. in. side bottom and side top.

Drilling of compartment door



Tightening torque for fastening screws Nm 20 - 177 lb/in
 Tightening torque for main terminals Nm 70 - 620 lb/in
 Tightening torque for earthing screw Nm 70 - 620 lb/in

	High strength M12 screw Number per terminal	
		PHASE
	E2	2
	E3	3
	E4	4
	E6	6



Content

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Electrical accessories for Tmax T6	7/9
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Electrical accessories for Emax	7/13

Circuit diagrams

Reading information – Tmax T6 circuit-breakers

Operating status shown

The diagram is shown in the following conditions:

- withdrawable circuit-breaker, open and racked in
- circuits de-energised
- trip units not tripped
- motor operator with springs charged.

Version

The diagram shows a circuit-breaker or switch-disconnector in the withdrawable version (T6). The diagram is also valid for the fixed version circuit-breakers or switch-disconnectors. With the fixed version circuit-breakers or switch-disconnectors, the applications indicated in figures 26-27-28-29-30 and 31 cannot be provided.

Caption

□	=	Figure number of the diagram
*	=	See note indicated by the letter
A1	=	Circuit-breaker applications
A17	=	Unit for M motor electrical latching
A2	=	Applications of the motor operator
A4	=	Indication apparatus and connections for control and signalling, outside the circuit-breaker
D	=	Electronic time-delay device of the undervoltage release (outside the circuit-breaker)
H, H1	=	Signalling lamps
K51	=	Electronic trip unit: <ul style="list-style-type: none">- PR222VF, type overcurrent release, with the following protection functions:<ul style="list-style-type: none">• L against overload with inverse long time delay• I against short-circuit with instantaneous trip time
K51/1...8	=	Contact for electrical signalling of the protection functions of the electronic trip unit
M	=	Motor for circuit-breaker opening and circuit-breaker closing spring charging
M1	=	Three-phase asynchronous motor
Q	=	Main circuit-breaker
Q/0,1,2,3	=	Auxiliary circuit-breaker contacts
R	=	Resistor (see note F)
R1	=	Motor thermistor
R2	=	Thermistor in the motor operator
S1, S2	=	Contacts controlled by the cam of the motor operator
S3, S3/1	=	Change-over contact for electrical signalling of local/remote selector status
S4/1-2	=	Contacts activated by the circuit-breaker rotary handle (see note C)
S51/S	=	Contact for electrical signalling of overload in progress (start)
S75/1...3	=	Contacts for electrical signalling of circuit-breaker in racked-in position (only provided with circuit-breakers in withdrawable version)
S75S/1...3	=	Contacts for electrical signalling of circuit-breaker in racked-out position (only provided with circuit-breakers in withdrawable version)
SC	=	Pushbutton or contact for closing the circuit-breaker
SC3	=	Pushbutton for motor starting
SO	=	Pushbutton or contact for opening the circuit-breaker
SO1, SO2	=	Pushbuttons or contacts for the circuit-breaker opening (see Resetting instructions for circuit-breaker tripped by trip units)
SO3	=	Pushbutton for stopping the motor
SQ	=	Contact for electrical signalling of circuit-breaker open
SY	=	Contact for electrical signalling of circuit-breaker open due to YO, YO1, YO2 or YU thermomagnetic trip unit intervention (tripped position)
TI/L1	=	Current transformer placed on phase L1
TI/L2	=	Current transformer placed on phase L2
TI/L3	=	Current transformer placed on phase L3
X1,X2,X5...X9	=	Connectors for the circuit-breaker auxiliary circuits (in the case of circuit-breakers in plug-in version, removal of the connectors takes place simultaneously with that of the circuit-breaker. See note E).
X11	=	Back-up terminal box
X3	=	Connectors for the circuits of the electronic trip unit (in the case of circuit-breakers in the withdrawable version, removal of the connectors takes place simultaneously with that of the circuit-breaker)
XA	=	Interfacing connector of the PR222/VF trip unit
XA1	=	Three-way connector for YO/YU (see note E)
XA2	=	Twelve-way connector for auxiliary contacts (see note E)
XA6	=	Three-way connector for contact of electrical signalling of circuit-breaker open due to trip of the overcurrent release (see note E)
XA7	=	Six-way connector for auxiliary contacts (see note E)
XA8	=	Six-way connector for contacts operated by the rotary handle or for the motor operator (see note E)

X0	= Connector for the YO1 trip coil
X01	= Connector for the YO2 trip coil
XV	= Terminal boxes of the applications
YC	= Closing release of the motor operating mechanism
YO	= Opening release
YO1	= Trip coil of the electronic trip unit
YU	= Undervoltage release (see note B).

Description of figures

Fig. 1	= Opening release.
Fig. 2	= Permanent opening release.
Fig. 3	= Instantaneous undervoltage release (see note B and F).
Fig. 4	= Undervoltage release with electronic time-delay device outside the circuit-breaker (see note B).
Fig. 5	= Instantaneous undervoltage release in version for machine tools with one contact in series (see note B, C, and F).
Fig. 6	= Instantaneous undervoltage release in version for machine tools with two contacts in series (see note B, C, and F).
Fig. 11	= Stored energy motor operator.
Fig. 12	= Local/remote auxiliary contact for stored-energy motor operating mechanism.
Fig. 21	= Three changeover contacts for electrical signalling of circuit-breaker open or closed and one changeover contact for electrical signalling of circuit-breaker open due to YO, YO1, YO2 and YU thermomagnetic trip unit intervention (tripped position).
Fig. 22	= One changeover contact for electrical signalling of circuit-breaker open or closed and a changeover contact for electrical signalling of circuit-breaker open due to YO, YO1, YO2 or YU the thermomagnetic trip unit intervention (tripped position).
Fig. 23	= Two changeover contacts for electrical signalling of circuit-breaker open or closed.
Fig. 25	= One contact for electrical signalling of circuit-breaker open due to overcurrent release trip
Fig. 26	= First position of circuit-breaker changeover contact, for electrical signalling of racked-in.
Fig. 27	= Second position of circuit-breaker changeover contact, for electrical signalling of racked-in.
Fig. 28	= Third position of circuit-breaker changeover contact, for electrical signalling of racked-in.
Fig. 29	= First position of circuit-breaker changeover contact, for electrical signalling of isolated.
Fig. 30	= Second position of circuit-breaker changeover contact, for electrical signalling of isolated.
Fig. 31	= Third position of circuit-breaker changeover contact, for electrical signalling of isolated.
Fig. 41	= Auxiliary circuits of the PR222/VF electronic trip.

Incompatibility

The circuits indicated by the following figures cannot be supplied at the same time on the same circuit-breaker:

1 - 2 - 3 - 4 - 5 - 6
 5 - 6 - 11
 21 - 22 - 23

Notes

- The circuit-breaker is only fitted with the applications specified in the ABB SACE order confirmation. To make out the order, please consult this catalogue.
- The undervoltage release is supplied for power supply branched on the supply side of the circuit-breaker or from an independent source: circuit-breaker closing is only allowed with the release energised (the lock on closing is made mechanically).
- The S4/1 and S4/2 contacts shown in figures 5-6 open the circuit with the circuit-breaker open and close it again when a manual closing command is given by means of the rotary handle, in accordance with the Standards regarding machine tools (in any case, closing does not take place if the undervoltage release is not supplied).
- Connectors XA1, XA2, XA6, XA7 and XA8 are supplied on request. Connectors X1, X2, X5, X6, X7, X8 and X9 are supplied on request. They are always supplied with T6 circuit-breakers in the fixed version or in the withdrawable version equipped with unwired electronic accessories.
- Additional external resistor for undervoltage release supplied at 250 V DC, 380/440 V AC and 480/500 V AC.

Circuit diagrams

Reading information – Emax circuit-breakers

Warning

Before installing the circuit-breaker, carefully read notes F on the circuit diagrams.

Operating status shown

The circuit diagram is for the following conditions:

- withdrawable circuit-breaker, open and racked-in
- circuits de-energised
- trip units not tripped
- motor operating mechanism with springs discharged.

Versions

Though the diagram shows a circuit-breaker in withdrawable version, it can be applied to a fixed version circuit-breaker as well.

Fixed version

The control circuits are fitted between terminals XV (connector X is not supplied).

With this version, the applications indicated in figures 31A and 32A cannot be provided.

Withdrawable version

The control circuits are fitted between the poles of connector X (terminal box XV is not supplied).

Version without overcurrent release

With this version, the applications indicated in figures 13A, 14A, 42A, 45A, 46A, 47A cannot be provided.

Version with PR111/VF electronic trip unit

With this version, the applications indicated in figures 42A, 45A, 46A, 47A cannot be provided.

Version with PR122/VF electronic trip unit

Caption

□	=	Circuit diagram figure number
*	=	See note indicated by letter
A1	=	Circuit-breaker accessories
A3	=	Accessories applied to the fixed part of the circuit-breaker (for withdrawable version only)
A4	=	Example switchgear and connections for control and signalling, outside the circuit-breaker
AY	=	SOR TEST UNIT Test/monitoring Unit (see note R)
D	=	Electronic time-delay device of the undervoltage trip unit, outside the circuit-breaker
F1	=	Delayed-trip fuse
K51	=	PR111/VF, PR122/VF electronic trip unit with the following protection functions: - L overload protection with inverse long time-delay trip - setting I1 - I short-circuit protection with instantaneous time-delay trip - setting I3
K51/IN1	=	Digital programmable input (available only with Uaux and PR122/VF trip unit with indicator module PR120/K)
K51/P1...P4	=	Programmable electrical signalling (available only with Uaux and PR122/VF trip unit with indicator module PR120/K)
K51/SZin	=	Zone selectivity: input for protection S or "direct" input for protection D [only with Uaux. and PR122/VF trip unit (DFin)]
K51/YC	=	Closing control from PR122/VF electronic trip unit with communication module PR120/D-M
K51/YO	=	Opening control from PR122/VF electronic trip unit with communication module PR120/D-M
M	=	Motor for charging the closing springs
Q	=	Circuit-breaker
Q/1...27	=	Circuit-breaker auxiliary contacts
S33M/1...3	=	Limit contacts for spring-charging motor
S43	=	Switch for setting remote/local control
S51	=	Contact for electrical signalling of circuit-breaker open due to tripping of the overcurrent trip unit. The circuit-breaker may be closed only after pressing the reset pushbutton, or after energizing the coil for electrical reset (if available).
S75E/1...4	=	Contacts for electrical signalling of circuit-breaker in racked-out position (only with withdrawable circuit-breakers)
S75I/1...5	=	Contacts for electrical signalling of circuit-breaker in racked-in position (only with withdrawable circuit-breakers)
S75T/1...4	=	Contacts for electrical signalling of circuit-breaker in test isolated position (only with withdrawable circuit-breakers)
SC	=	Pushbutton or contact for closing the circuit-breaker
SO	=	Pushbutton or contact for opening the circuit-breaker
SO1	=	Pushbutton or contact for opening the circuit-breaker with delayed trip
SO2	=	Pushbutton or contact for opening the circuit-breaker with instantaneous trip
SR	=	Pushbutton or contact for electrical circuit-breaker reset
TI/L1	=	Current transformer located on phase L1
TI/L2	=	Current transformer located on phase L2

TI/L3	=	Current transformer located on phase L3
Uaux.	=	Auxiliary power supply voltage (see note F)
UI/L1	=	Current sensor (Rogowski coil) located on phase L1
UI/L2	=	Current sensor (Rogowski coil) located on phase L2
UI/L3	=	Current sensor (Rogowski coil) located on phase L3
W1	=	Serial interface with control system (external bus): EIA RS485 interface (see note E)
W2	=	Serial interface with the accessories of PR122/VF trip unit (internal bus)
X	=	Delivery connector for auxiliary circuits of withdrawable version circuit-breaker
X1...X7	=	Connectors for the accessories of the circuit-breaker
XF	=	Delivery terminal box for the position contacts of the withdrawable circuit-breaker (located on the fixed part of the circuit-breaker)
XK1	=	Connector for power circuits of PR111/VF trip units
XK2	=	Connectors for auxiliary circuits of PR122/VF trip units
XK4	=	Connector signalling open/closed contact
XK11...XK13	=	Connector for power circuits of PR122/VF trip unit
XO	=	Connector for YO1 release
XV	=	Delivery terminal box for the auxiliary circuits of the fixed circuit-breaker
YC	=	Shunt closing release
YO	=	Shunt opening release
YO1	=	Overcurrent shunt opening release
YO2	=	Second shunt opening release (see note Q)
YR	=	Coil to electrically reset the circuit-breaker
YU	=	Undervoltage release (see notes B and Q)

Description of figures

Fig. 1A	=	Motor circuit to charge the closing springs.
Fig. 2A	=	Circuit of shunt closing release.
Fig. 4A	=	Shunt opening release.
Fig. 6	=	Instantaneous undervoltage release (see notes B and Q).
Fig. 7A	=	Undervoltage trip unit with electronic time-delay device, outside the circuit-breaker (see notes B and Q)
Fig. 8A	=	Second shunt opening release (see note Q).
Fig. 11A	=	Contact for electrical signalling of springs charged.
Fig. 12A	=	Contact for electrical signalling of undervoltage release energized (see notes B and S).
Fig. 13A	=	Contact for electrical signalling of circuit-breaker open due to tripping of the overcurrent release. The circuit-breaker may be closed only after pressing the reset pushbutton.
Fig. 14A	=	Contact for electrical signalling of circuit-breaker open due to tripping of the overcurrent release and electrical reset coil. The circuit-breaker may be closed only after pressing the reset pushbutton or energizing the coil.
Fig. 21A	=	First set of circuit-breaker auxiliary contacts.
Fig. 22A	=	Second set of circuit-breaker auxiliary contacts (see note V).
Fig. 23A	=	Third set of supplementary auxiliary contacts outside the circuit-breaker.
Fig. 31A	=	First set of contacts for electrical signalling of circuit-breaker in racked-in, test isolated, racked-out position.
Fig. 32A	=	Second set of contacts for electrical signalling of circuit-breaker in racked-in, test isolated, racked-out position.
Fig. 42A	=	Auxiliary circuits of PR122/VF trip unit (see notes F and V).
Fig. 45A	=	Circuits of the communication module PR120/D-M of the 122/VF trip unit (optional - see note E).
Fig. 46A	=	Circuits of the indicator module PR120/K of the 122/VF trip unit - connection 1 (optional - see note V).
Fig. 47A	=	Circuits of the indicator module PR120/K of the 122/VF trip unit - connection 2 (optional - see note V).
Fig. 61A	=	SOR TEST UNIT Test/monitoring unit (see note R).

Incompatibilities

The circuits indicated in the following figures cannot be supplied simultaneously on the same circuit-breaker:

- 6A – 7A – 8A
- 13A – 14A
- 22A – 46A – 47A

Circuit diagrams

Reading information – Emax circuit-breakers

Notes

- A) The circuit-breaker is only fitted with the accessories specified in the ABB SACE order acknowledgement. Consult this catalogue for information on how to make out an order.
- B) The undervoltage release is supplied for operation using a power supply branched on the supply side of the circuit-breaker or from an independent source. The circuit-breaker can only close when the release is energized (there is a mechanical lock on closing).
If the same power supply is used for the closing and undervoltage releases and the circuit-breaker is required to close automatically when the auxiliary power supply comes back on, a 30 ms delay must be introduced between the undervoltage release accept signal and the energizing of the closing trip unit. This may be achieved using an external circuit comprising a permanent make contact, the contact shown in fig. 12 and a time-delay relay.
- E) MODBUS map is available in the 1SDH000556R0001 document
- F) The PR122/VF trip unit requires the external power supply to activate the protection functions and the ammeter. Without the auxiliary power supply 24V DC the trip unit does not work and the circuit-breaker is not protected. It is recommended to use a backup battery to guarantee the presence of the Vaux or to add in the circuit-breaker an undervoltage release (YU) to open the circuit-breaker even when the auxiliary Vaux does not work.
The external auxiliary power supply must be provided using a galvanically-separated power pack dedicated only for one trip unit. Since the auxiliary voltage needs to be isolated from the ground, "galvanically separated converters" in accordance with the IEC standard 60950 (UL 1950) or the equivalent IEC 60364-41 have to be used to guarantee a current in common mode or leakage current (as defined in IEC 478/1) no greater than 3.5mA.
The connections for the auxiliary power supply must be made with a two-pole shielded twisted cable (e.g. type BELDEN 3105A/3105B), the shield must be earthed on the trip unit side.
The characteristics of the power pack are given in the table at page 4/11.
- P) With PR122/VF trip units with communication module PR120/D-M, the power supply for coils YO and YC must not be taken from the main power supply. The coils can be controlled directly from contacts K51/YO and K51/YC with maximum voltages of 110-120 V DC and 240-250 V AC.
- Q) The second opening trip unit may be installed as an alternative to the undervoltage trip unit.
- R) The SACE SOR TEST UNIT + opening release (YO) is guaranteed to operate starting at 75% of the Uaux of the opening release itself.
While the YO power supply contact is closing (short-circuit on terminals 4 and 5), the SACE SOR TEST UNIT is unable to detect the opening coil status. Consequently:
- For continuously powered opening coil, the TEST FAILED and ALARM signals will be activated
- If the coil opening command is of the pulsing type, the TEST FAILED signal may appear at the same time. In this case, the TEST FAILED signal is actually an alarm signal only if it remains lit for more than 20s.
- S) Also available in the version with normally-closed contact
- V) If fig. 22A is present (second set of auxiliary contacts) simultaneously as PR122/VF trip unit, the indicator module PR120/K in figures 46A and 47A cannot be supplied.

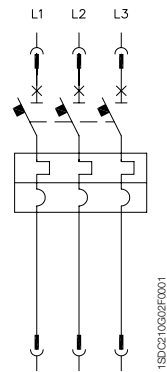
Circuit diagrams

Graphic symbols (IEC 60617 and CEI 3-14...3-26 Standards)

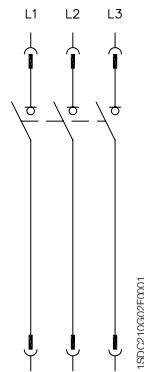
	Thermal effect		Conductors in a screened cable, two conductors shown		Break contact		Instantaneous overcurrent or rate-of-rise relay
	Electromagnetic effect		Twisted conductors, two conductors shown		Change-over break before make contact		Overcurrent relay with adjustable short time-lag characteristic
	Delay		Connection of conductors		Position switch (limit switch), make contact		Lamp, general symbol
	Mechanical connection (link)		Terminal		Position switch (limit switch), break contact		Mechanical interlock between two devices
	Manually operated control (general case)		Plug and socket (male and female)		Position switch (limit switch) change-over break before make contact		Operated by electric motor
	Operated by turning		Resistor (general symbol)		Contactor (contact open in the unoperated position)		Screen, shield (it may be drawn in any convenient shape)
	Operated by pushing		Motor (general symbol)		Circuit-breaker disconnector with automatic trip unit		Equipotentiality
	Operated by key		Current transformer		Switch-disconnector (on-load isolating switch)		Current sensing element
	Operated by cam		Converter with galvanic separator		Operating device (general symbol)		Current sensing resistor
	Hearth, grounding (general symbol)		Make contact		Thermal relay		Fuse (general symbol)

Circuit diagrams

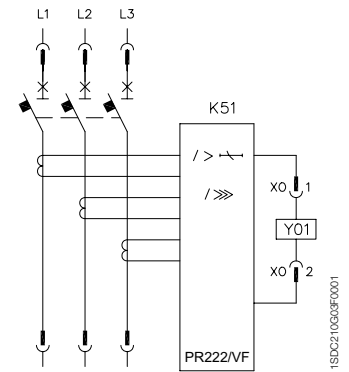
Tmax T6 circuit-breaker



Three-pole circuit-breaker with thermomagnetic trip unit



Three-pole switch-disconnector (on-load isolating switch)

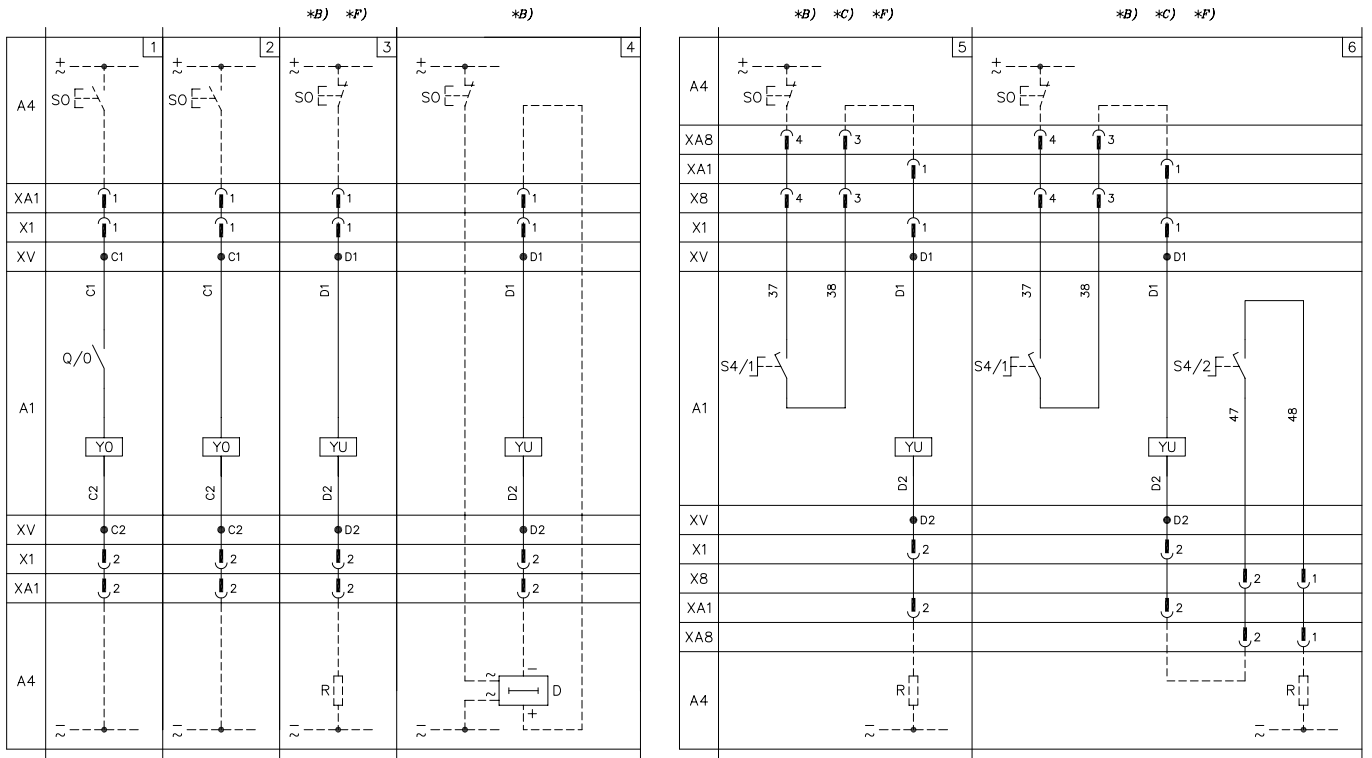


Three-pole circuit-breaker with PR222/VF electronic trip unit

Circuit diagrams

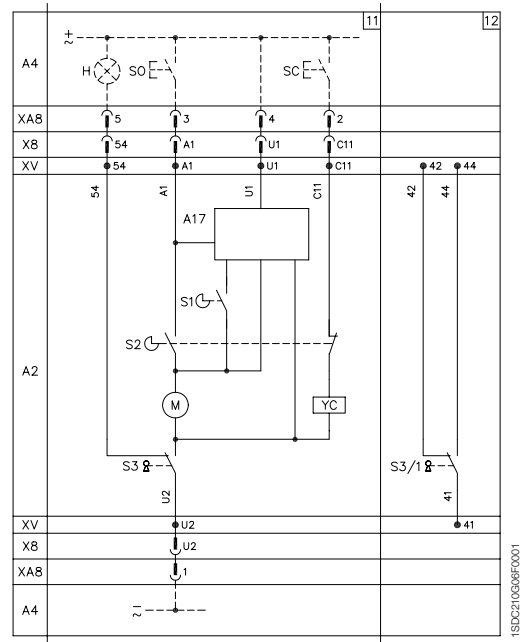
Electrical accessories for Tmax T6

Shunt opening and undervoltage releases



1SDC210669F0001

Remote control

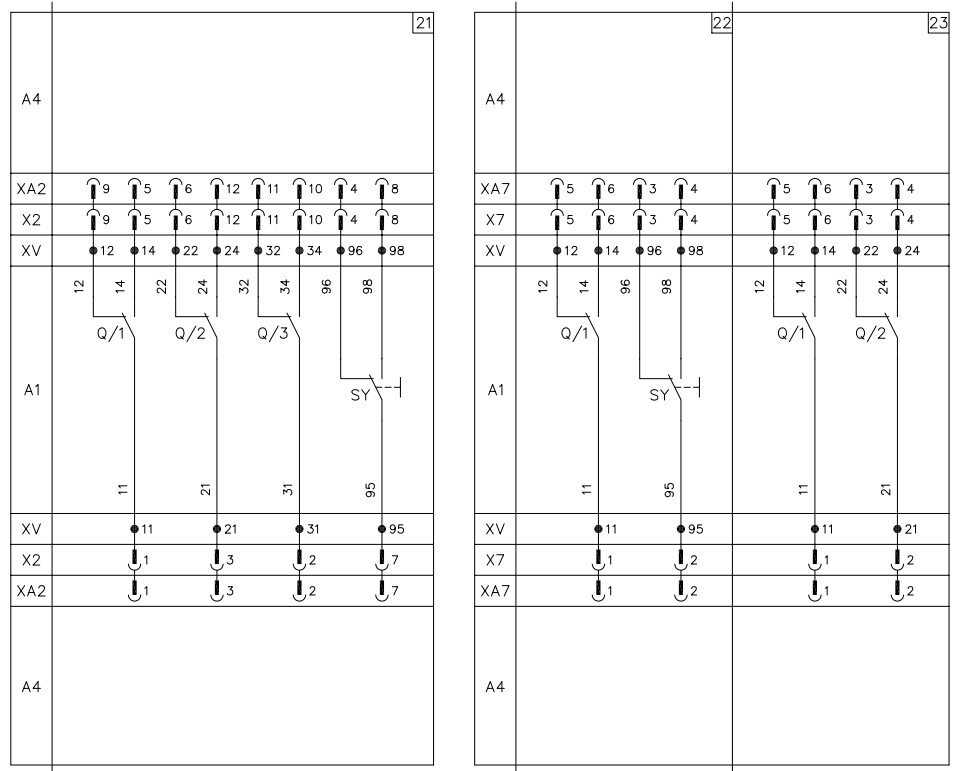


1SDC210669F0001

Circuit diagrams

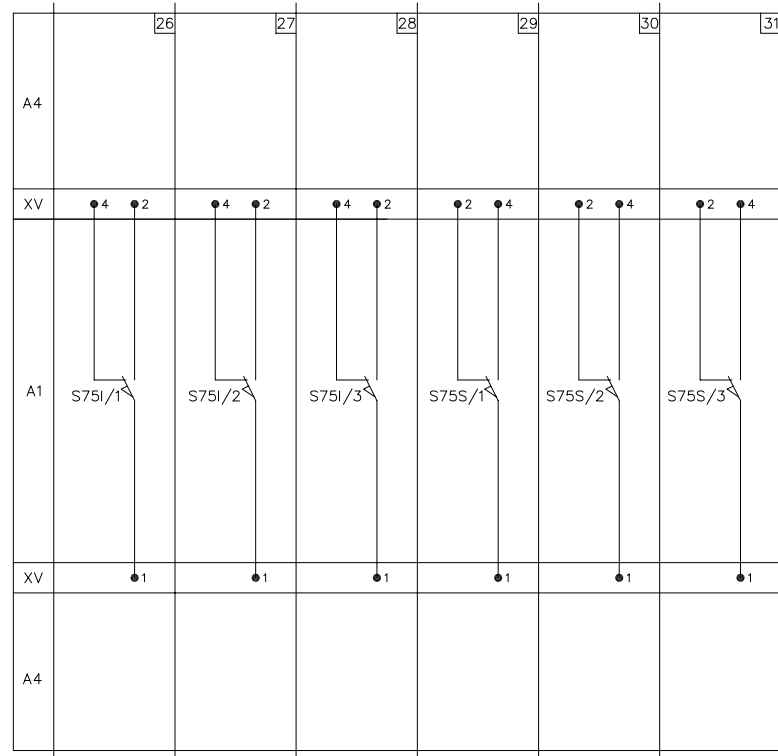
Electrical accessories for Tmax T6

Auxiliary contacts



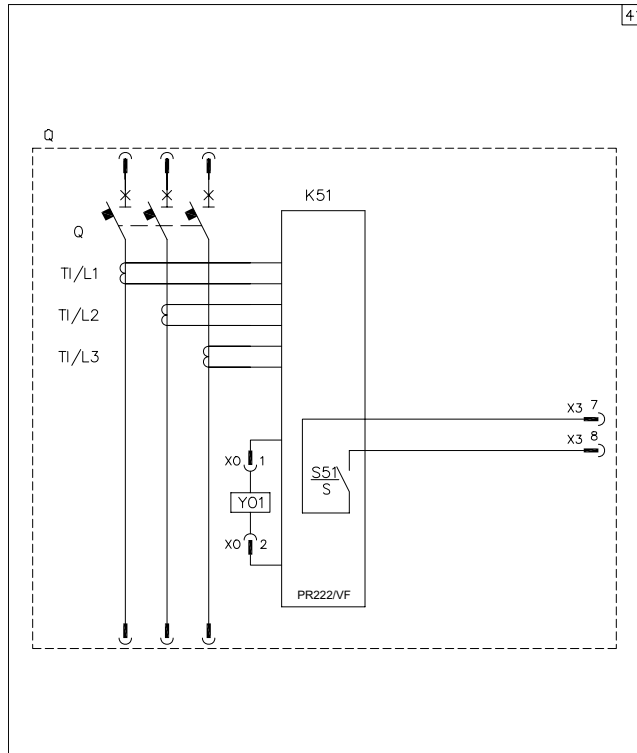
1SDC210607F0001

Position contacts



1SDC210608F0001

PR222/VF electronic trip unit

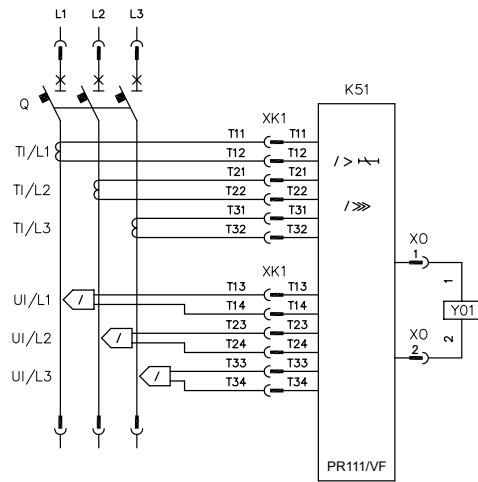


1SDC210306R0001

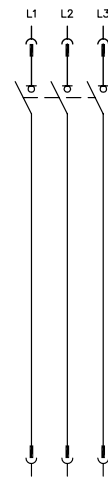
Circuit diagrams

Emax circuit-breakers

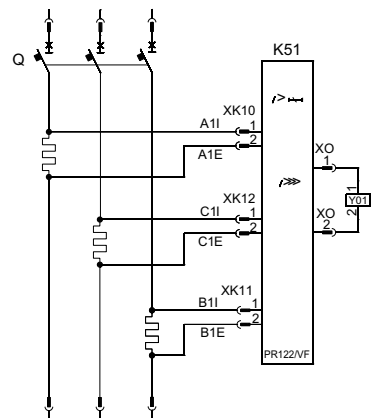
Operating status



Three-pole circuit-breaker with PR111/VF electronic trip unit



Three-pole switch-disconnector

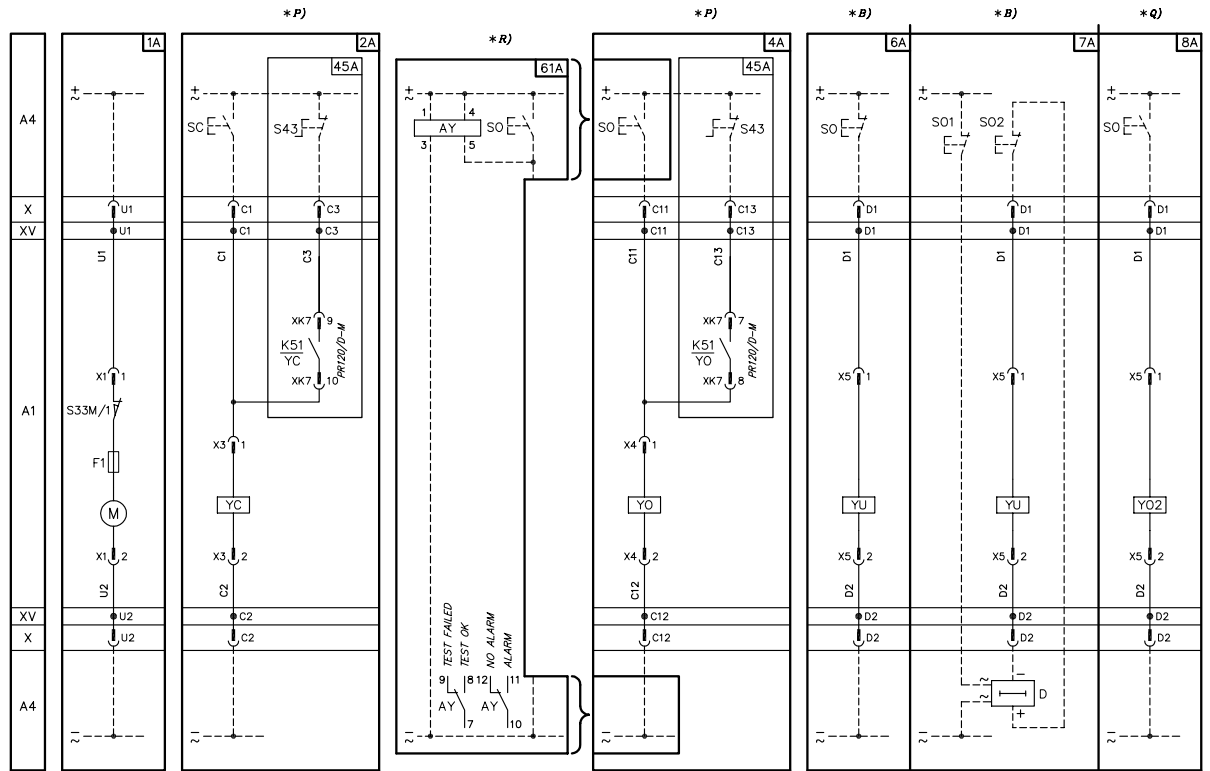


Three-pole circuit-breaker with PR122/VF electronic trip unit

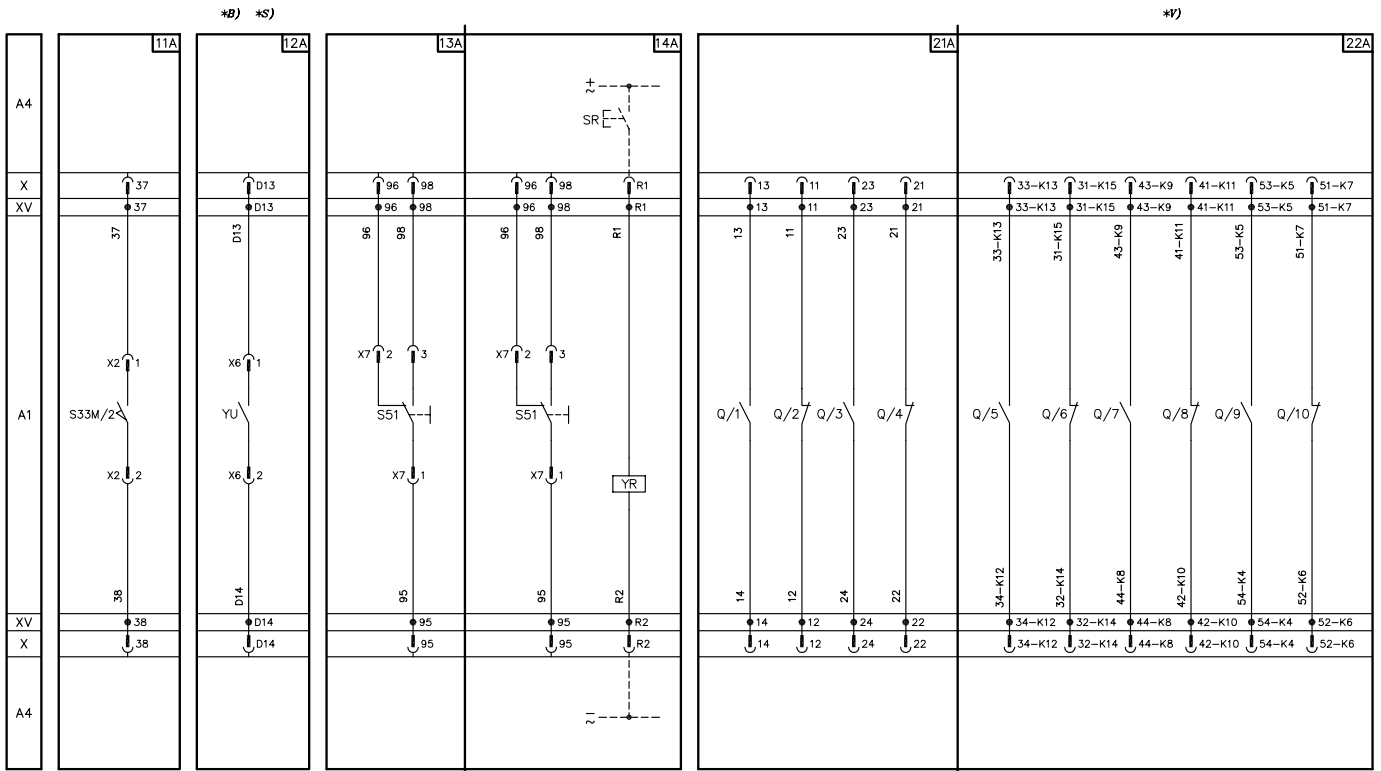
Circuit diagrams

Electrical accessories for Emax

Motor operating mechanism, opening, closing and undervoltage releases



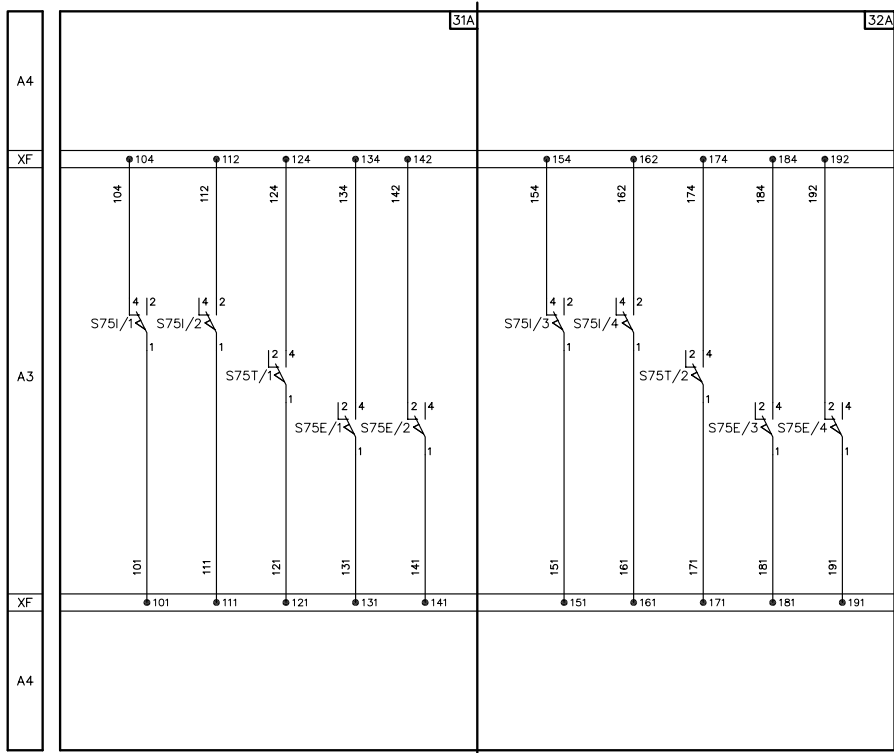
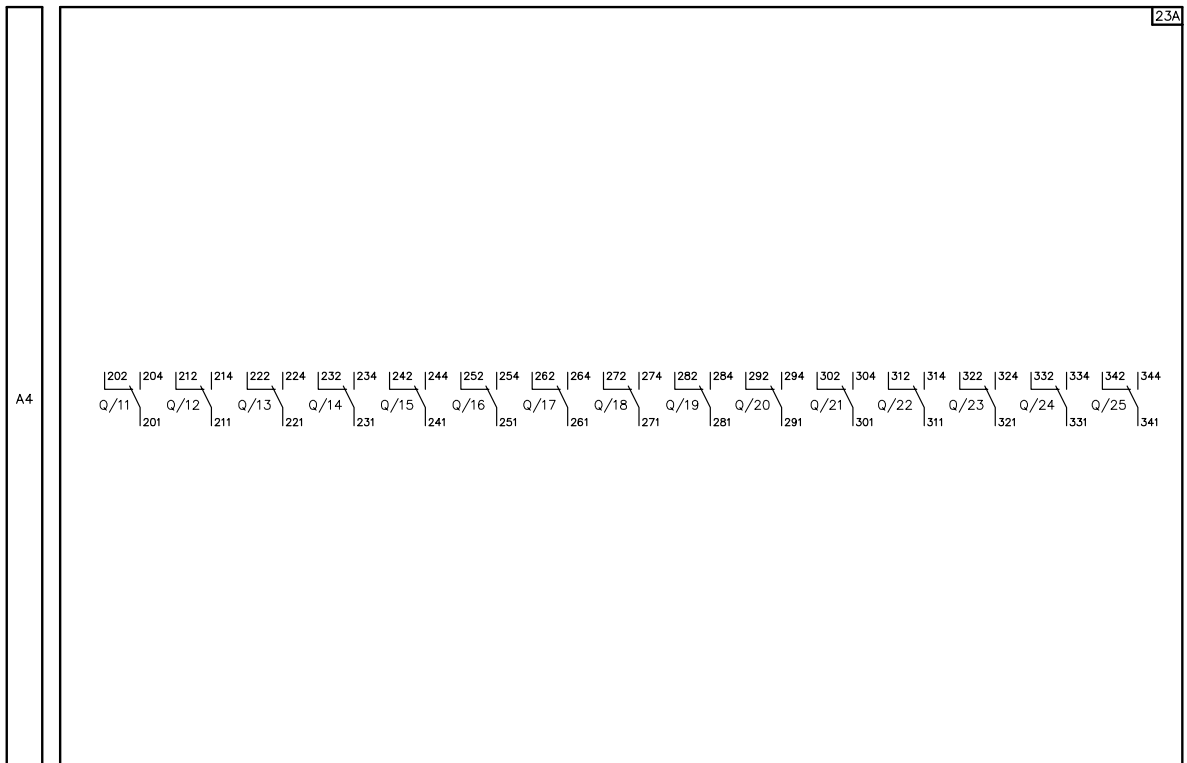
Signalling contacts



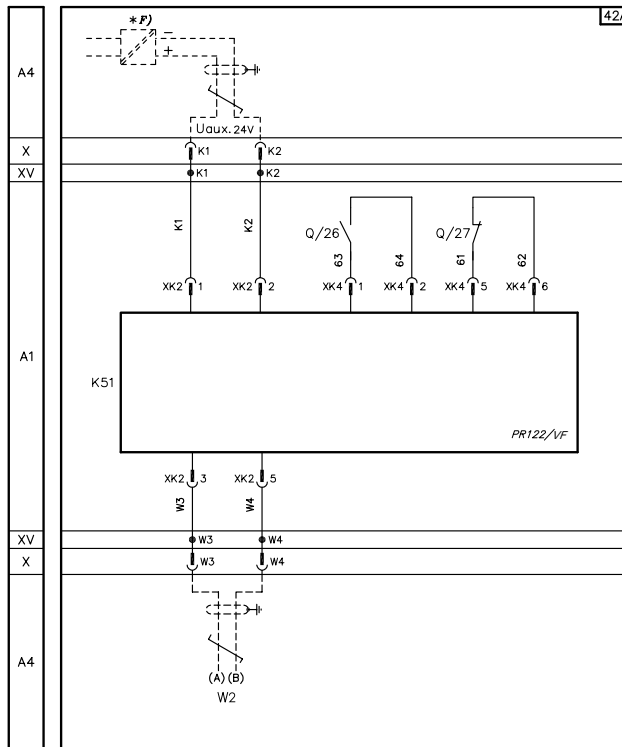
Circuit diagrams

Electrical accessories for Emax

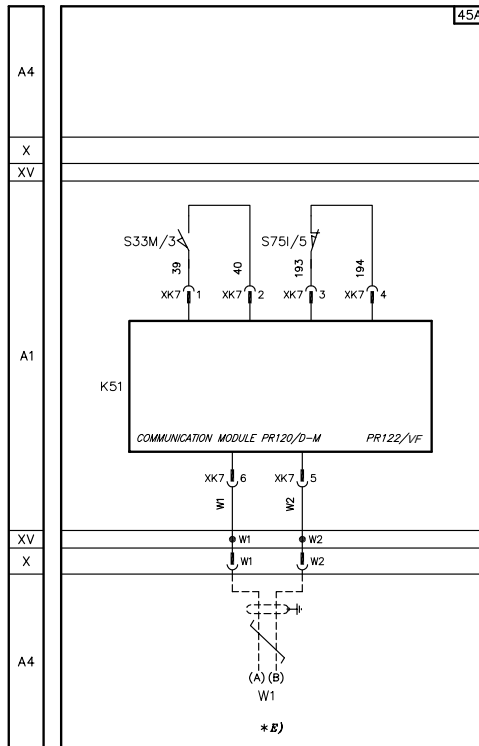
Signalling contacts



Auxiliary circuit of the PR122/VF trip units



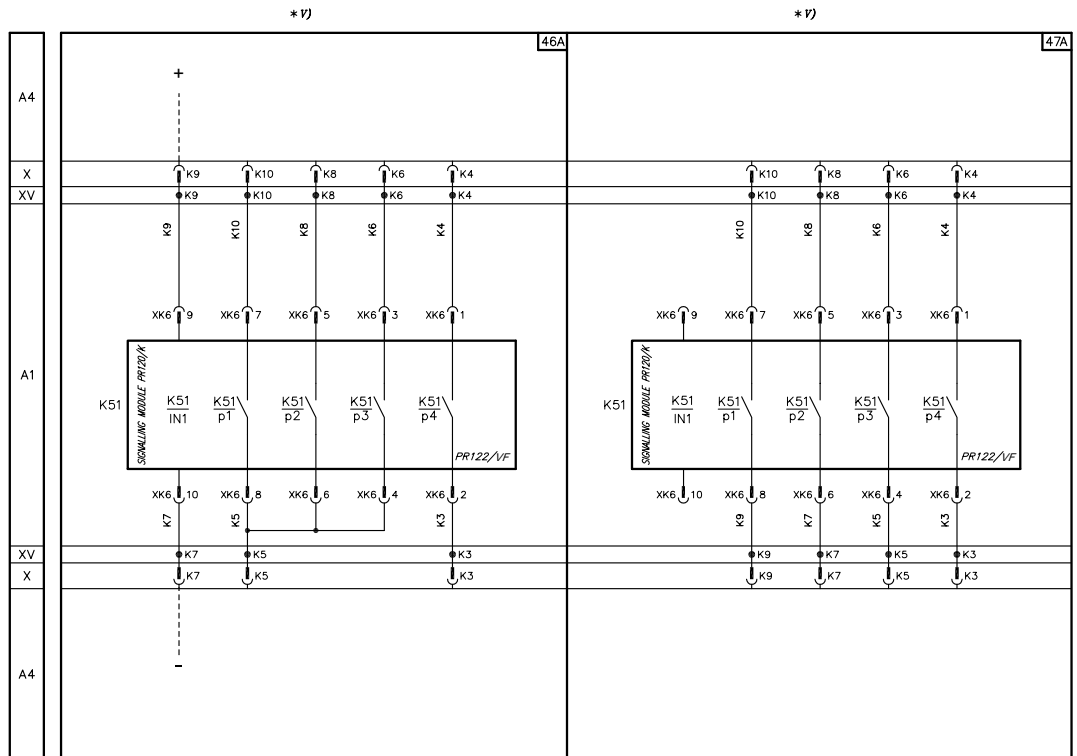
Communication module PR120/D-M



Circuit diagrams

Electrical accessories for Emax

Signalling module PR120/K





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Ordering codes

Tmax VF circuit-breakers

SACE Tmax VF – Automatic circuit-breaker for low frequency applications (1...60Hz)



		1SDA..... R1
		3 Poles
	Iu	Fixed
		Front terminals
T6L/VF 800 Thermomagnetic trip unit	800A	069505 ⁽¹⁾

⁽¹⁾ UL Listed

SACE Tmax VF – Automatic circuit-breaker for high frequency applications (20...200Hz)



		1SDA..... R1
		3 Poles
	Iu	Fixed
		Front terminals
T6L/VF 800 PR222/VF	800A	069506 ⁽¹⁾

⁽¹⁾ UL Listed

SACE Tmax VF – Switch disconnecter for variable frequency applications (1...200Hz)

		1SDA..... R1
		3 Poles
	Iu	Fixed
		Front terminals
T6D/VF 800	800A	069507

Ordering codes

Tmax fixed parts and conversion kits

Draw out (W) - Fixed part

VR = Rear flat vertical terminals	
	1SDA.....R1
	3 Poles
T6 800 W FP VR	060386 ⁽¹⁾

⁽¹⁾ UL Listed

HR = Rear flat horizontal terminals	
	1SDA.....R1
	3 Poles
T6 800 W FP HR	060385 ⁽¹⁾

⁽¹⁾ UL Listed

EF = Front extended terminals	
	1SDA.....R1
	3 Poles
T6 800 W FP EF	060384 ⁽¹⁾

⁽¹⁾ UL Listed

Conversion of the version



Conversion kit from fixed into moving part of draw out	
	1SDA.....R1
	3 Poles
Kit W MP T6 800	060390 ⁽¹⁾

Note: The draw out version must be composed as follows
a) Fixed circuit-breaker
b) Conversion kit from fixed into moving part of draw out
c) Fixed part of draw out
d) Front for lever operating mechanism or rotary handle or motor operator

⁽¹⁾ UL Listed

Terminals for fixed part	
	1SDA.....R1
	3 pieces
Rear flat vertical terminals - VR	
VR T6	013988
Rear flat horizontal terminals - HR	
HR T6	013986

Ordering codes

Accessories for Tmax



T6

1SDC210204F0004

Service releases

Shunt opening release – SOR

	1SDA.....R1
	T6
uncabled version	
SOR 12 V DC	054862
SOR 24...30 V AC / DC	054863
SOR 48...60 V AC / DC	054864
SOR 110...127 V AC - 110...125 V DC	054865
SOR 220...240 V AC - 220...250 V DC	054866
SOR 380...440 V AC	054867
SOR 480...500 V AC	054868
cabled version⁽¹⁾	
SOR-C 12 V DC	054869 ⁽²⁾
SOR-C 24...30 V AC / DC	054870 ⁽²⁾
SOR-C 48...60 V AC / DC	054871 ⁽²⁾
SOR-C 110...127 V AC - 110...125 V DC	054872 ⁽²⁾
SOR-C 220...240 V AC - 220...250 V DC	054873 ⁽²⁾
SOR-C 380...440 V AC	054874 ⁽²⁾
SOR-C 480...500 V AC	054875 ⁽²⁾

⁽¹⁾ Compulsory with T6 in the draw out or motorized versions

⁽²⁾ UL Listed



T6

1SDC210204F0004

Undervoltage release – UVR

	1SDA....R1
	T6
uncabled version	
UVR 24...30 V AC/DC	054880
UVR 48 V AC/DC	054881
UVR 60 V AC/DC	054882
UVR 110...127 V AC-110...125 V DC	054883
UVR 220...240 V AC-220...250 V DC	054884
UVR 380...440 V AC	054885
UVR 480...525 V AC	054886
cabled version⁽¹⁾	
UVR-C 24...30 V AC / DC	054887 ⁽²⁾
UVR-C 48 V AC / DC	054888 ⁽²⁾
UVR-C 60 V AC/DC	054889 ⁽²⁾
UVR-C 110...127 V AC - 110...125 V DC	054890 ⁽²⁾
UVR-C 220...240 V AC - 220...250 V DC	054891 ⁽²⁾
UVR-C 380...440 V AC	054892 ⁽²⁾
UVR-C 480...500 V AC	054893 ⁽²⁾

⁽¹⁾ Compulsory with T6 in the draw out or motorized versions

⁽²⁾ UL Listed

Shunt opening with permanent operation – PS-SOR

	1SDA....R1
	T6
uncabled version	
PS-SOR 24 V AC/DC	054876
PS-SOR 110...120 V AC	054877
cabled version	
PS-SOR-C 24 V AC/DC	054878 ⁽¹⁾
PS-SOR-C 110...120 V AC	054879 ⁽¹⁾

⁽¹⁾ UL Listed



1SDC2210147F0004

Connectors and socket-plugs for electrical accessories

	1SDA....R1
	T6
Socket-plug 12 poles	051362
Socket-plug 6 poles	051363
Socket-plug 3 poles	051364
3-way connector for second SOR-C	055273

Time delay device for undervoltage release – UVD

	1SDA....R1
	T6
UVD 24...30 V AC / DC	051357
UVD 48...60 V AC / DC	051358
UVD 110...125 V AC / DC	051360
UVD 220...250 V AC / DC	051361

Auxiliary contacts – AUX

	1SDA....R1
	T6
uncabled version	
AUX 1Q 1SY 250 V AC/DC	051368
AUX 3Q 1SY 250 V AC/DC	051369
AUX 3Q 1SY 24 V DC	054914
cabled version with 1 m long cables	
AUX-C 1Q 1SY 250 V AC/DC	054910 ⁽³⁾
AUX-C 3Q 1SY 250 V AC/DC	054911 ⁽³⁾
AUX-C 1Q 1SY 400 V AC	054912 ⁽³⁾
AUX-C 2Q 400 V AC	054913 ⁽³⁾
AUX-C 3Q 1SY 24 V DC	054915
cabled contact for signalling trip coil release trip	
AUX-SA 1 S51 ⁽¹⁾	060393
cabled contact for signalling manual/remote operation	
AUX-MO-C ⁽²⁾	054917

– Q = Bell alarm
– SY = Form C

⁽¹⁾ Available only mounted on the circuit-breaker.

⁽²⁾ For T6 in draw out version, it is necessary to order a socket plug connector 3 poles 1SDA051364R1.

⁽³⁾ UL Listed.

Auxiliary position contacts – AUP

	1SDA....R1
	T6
AUP-I 24 V DC	
1 contact signalling circuit-breakers racked-in	054920
AUP-I 400 V AC/DC	
1 contact for signalling circuit-breakers racked-in	054918
AUP-R 24 V DC	
1 contact for signalling circuit-breakers racked-out	054921
AUP-R 400 V AC/DC	
1 contact for signalling circuit-breakers racked-out	054919

Note: For T6 in draw out version, contacts signaling circuit-breaker racked-in.

⁽¹⁾ UL Listed

Ordering codes

Accessories for Tmax

Early auxiliary contacts – AUE

	1SDA.....R1
	T6
AUE - early contacts	060394

Adapters – ADP

	1SDA.....R1
	T6
ADP - Adapters 5pin	055173
ADP - Adapters 6pin	054922
ADP - Adapters 12pin	054923
ADP - Adapters 10pin	054924

Testing extension

	1SDA.....R1
	T6
5pin checking extension for blank tests on T6 W service releases	055351
6pin checking extension for blank tests on T6 W auxiliary contacts (1+1) service and residual current releases	055063
12pin checking extension for blank tests on T6 W auxiliary contacts (3+1)	055064
5pin checking extension for blank tests on T6 W motor operator and early contacts	055065



1SDC21025F0004

Stored energy motor operator – MOE

	1SDA.....R1
	T6
MOE 24 V DC	060395 ⁽¹⁾
MOE 48...60 V DC	060396 ⁽¹⁾
MOE 110...125 V AC/DC	060397 ⁽¹⁾
MOE 220...250 V AC/DC	060398 ⁽¹⁾
MOE 380 V AC	060399 ⁽¹⁾



1SDC210207F0004

⁽¹⁾ UL Listed

Rotary handle operating mechanism



1SDC210209F004

Direct – RHD

	1SDA.....R1
	T6
RHD normal for fixed and plug-in	060405 ⁽¹⁾
RHD_EM emergency for fixed and plug-in	060406 ⁽¹⁾
RHD normal for draw out	060407 ⁽¹⁾
RHD_EM di emergency for draw out	060408 ⁽¹⁾

⁽¹⁾ UL Listed



1SDC210209F004

Transmitted – RHE

	1SDA.....R1
	T6
RHE normal for fixed and plug-in	060409 ⁽¹⁾
RHE_EM emergency for fixed and plug-in	060410 ⁽¹⁾
RHE normal for draw out	060411 ⁽¹⁾
RHE_EM di emergency for draw out	060412 ⁽¹⁾

Individual components

RHE_B just base for RHE for fixed and plug-in	060413 ⁽¹⁾
RHE_B just base for RHE draw out	060414 ⁽¹⁾
RHE_S just rod 19.68" (500 mm) for RHE	054932 ⁽¹⁾
RHE_H just handle for RHE	060415 ⁽¹⁾
RHE_H_EM just emergency handle for RHE	060416 ⁽¹⁾

⁽¹⁾ UL Listed



1SDC210209F004

IP54 protection for rotary handle

	1SDA.....R1
	T6
RHE_IP54 protection kit IP54	054938 ⁽¹⁾

⁽¹⁾ UL Listed

Key lock for front/rotary handle – KLF

	1SDA.....R1
	T6
KLF-D - different key	060658
KLF-S - same key for different groups of circuit-breakers (N. 20005)	060659
KLF-S - same key for different groups of circuit-breakers (N. 20006)	060660
KLF-S - same key for different groups of circuit-breakers (N. 20007)	060661
KLF-S - same key for different groups of circuit-breakers (N. 20008)	060662

Ordering codes

Accessories for Tmax

Key lock for motor operator – MOL

	1SDA.....R1
	T6
MOL-D different key	060611
MOL-S - same key for different groups of circuit-breakers (N. 20005)	060612
MOL-S - same key for different groups of circuit-breakers (N. 20006)	060613
MOL-S - same key for different groups of circuit-breakers (N. 20007)	060614
MOL-S - same key for different groups of circuit-breakers (N. 20008)	060615
MOL-M - lock only on manual operation with same key	054909



Front lever operating mechanism – FLD

	1SDA.....R1
	T6
FLD - for fixed	060417 ⁽¹⁾
FLD - for draw out	060418 ⁽¹⁾

⁽¹⁾ UL Listed

Mechanical interlock – MIR

	1SDA.....R1
	T6
Horizontal interlock	060685 ⁽¹⁾
Vertical interlock	060686 ⁽¹⁾

⁽¹⁾ UL Listed

Connections terminals

High insulating terminal covers – HTC

	1SDA.....R1
	3 Poles
HTC T6	014040

⁽¹⁾ UL Listed



Low insulating terminal covers – LTC

	1SDA.....R1
	3 Poles
LTC T6	014038





1SDC210127F0004

Sealable screws for terminal covers

		1SDA.....R1	
		T6	
Sealable screws		013699	



1SDC210203F0004

Separating partitions – PB

		1SDA.....R1	
		T6	
PB100 low (H = 3.94"/100 mm) - 4 pieces - 3 poles		050696	

Front terminals for copper-aluminium cables – FC CuAl

		1SDA.....R1	
		3 pieces	6 pieces
FC CuAl T6 800 A 3x185 mm ²		052044 ⁽¹⁾	052048 ⁽¹⁾

⁽¹⁾ UL Listed



1SDC210887F0004

Front terminals – F⁽¹⁾

		1SDA.....R1	
		3 pieces	6 pieces
F T6 - Plugs with screws		060421	060423

⁽¹⁾ To be requested as loose kit



1SDC210509F0001

Rear terminals

		1SDA.....R1	
		3 pieces	6 pieces
R T6		060425	060427

Accessories for electronic trip units

		1SDA.....R1	
		T6	
X3 Connector for fixed circuit-breaker with PR222/VF		055059	
X3 Connector for plug-in/draw out circuit-breaker with PR222/VF		055061	
Ekip TT - Trip Test Unit		066988	

Ordering codes

Emax VF circuit-breakers

SACE Emax VF - Automatic circuit breaker for low frequency applications (1...60Hz)



1SDA..... R1			
3 Poles			
	Iu	Fixed	Withdrawable
		Horizontal terminals	Moving part
E2N/VF 12 PR122/VF	1200A	069477	069473
E2N/VF 16 PR122/VF	1600A	069478	069474
E3H/VF 20 PR122/VF	2000A	069479	069475
E3H/VF 25 PR122/VF	2500A	069480	069476

SACE Emax VF - Automatic circuit-breakers for high frequency applications (20...200Hz)



1SDA..... R1			
3 Poles			
	Iu	Fixed	Withdrawable
		Horizontal terminals	Moving part
E2N/VF 12 PR111/VF	1200A	069487	069481
E2N/VF 16 PR111/VF	1600A	069488	069482
E3H/VF 20 PR111/VF	2000A	069489	069483
E3H/VF 25 PR111/VF	2500A	069490	069484
E4H/VF 36 PR111/VF	3600A	069491	069485
E6H/VF 50 PR111/VF	5000A	069492	069486

SACE Emax VF - Switch disconnectors for variable frequency applications (1...200Hz)

1SDA..... R1			
3 Poles			
	Iu	Fixed	Withdrawable
		Horizontal terminals	Moving part
E2N/VF MS 12	1200A	069499	069493
E2N/VF MS 16	1600A	069500	069494
E3H/VF MS 20	2000A	069501	069495
E3H/VF MS 25	2500A	069502	069496
E4H/VF MS 36	3600A	069503	069497
E6H/VF MS 50	5000A	069504	069498

Ordering codes

Emax fixed parts

E2N/VF - Draw out (W) - FP for automatic circuit-breakers for low frequency

	1SDA....R1
FP= Fixed Part	3 poles
HR	069586
VR	069587
HR-VR	069508
VR-HR	069509

E2N/VF - Draw out (W) - FP for automatic circuit-breakers for high frequency and switch disconnectors

	1SDA....R1
FP= Fixed Part	3 poles
HR	061511
VR	061514
HR-VR	061512
VR-HR	061513

E3H/VF - Draw out (W) - FP for automatic circuit-breakers for low frequency

	1SDA....R1
FP= Fixed Part	3 poles
HR	069588
VR	069589
HR-VR	069510
VR-HR	069511

E3H/VF - 20 - Draw out (W) - FP for automatic circuit-breakers for high frequency and switch disconnectors

	1SDA....R1
FP= Fixed Part	3 poles
HR	061545
VR	061529
HR-VR	061527
VR-HR	061528

E3H/VF - 25 - Draw out (W) - FP for automatic circuit-breakers for high frequency and switch disconnectors

	1SDA....R1
FP= Fixed Part	3 poles
HR	061545
VR	061535
HR-VR	061533
VR-HR	061534

E4H/VF - Draw out (W) - FP for automatic circuit-breakers for high frequency and switch disconnectors

	1SDA....R1
FP= Fixed Part	3 poles
HR	061567
VR	061570
HR-VR	061568
VR-HR	061569

E6H/VF - Draw out (W) - FP for automatic circuit-breakers for high frequency and switch disconnectors

	1SDA....R1
FP= Fixed Part	3 poles
HR	061579
VR	061582
HR-VR	061580
VR-HR	061581

Note: HR-VR = Upper HR terminals, lower VR terminals;
VR-HR = Upper VR terminals, lower HR terminals;

Ordering codes

Emax fixed parts

Kit for converting fixed circuit-breaker with horizontal rear terminals to vertical rear terminals

1SDA....R1

3 poles

Automatic circuit-breaker for low frequency applications

E2 038053

E3 038054

Automatic circuit-breaker for high frequency applications and switch disconnectors

E2 050046

E3 (20) 050047

E3 (25) 050048

E4 050049

E6 050050

Note: Each kit is prepared for top or bottom application. For conversion of a complete circuit-breaker, order 2 kits.
Extracode 1SDA050230R1 to be specified in case of 1/2 terminal kit (HR) standard.

Ordering codes

Accessories for Emax

Electrical accessories

Shunt opening release - YO (1a)

		1SDA...R1
E2/6	24V DC	038286
E2/6	30V AC / DC	038287
E2/6	48V AC / DC	038288
E2/6	60V AC / DC	038289
E2/6	110...120V AC / DC	038290
E2/6	120...127V AC / DC	038291
E2/6	220...240V AC / DC	038292
E2/6	240...250V AC / DC	038293
E2/6	380...400V AC	038294
E2/6	440...480V AC	038295

Note: the shunt opening (YO) and closing (YC) releases are constructionally identical and therefore interchangeable. Their function is linked to the assembly position on the circuit-breaker.

Second shunt opening release - YO2 (1a)

		1SDA...R1
E2/6	24V DC	050157
E2/6	30V AC / DC	050158
E2/6	48V AC / DC	050159
E2/6	60V AC / DC	050160
E2/6	110...120V AC / DC	050161
E2/6	120...127V AC / DC	050162
E2/6	220...240V AC / DC	050163
E2/6	240...250V AC / DC	050164
E2/6	380...400V AC	050165
E2/6	440...480V AC	050166

Note: supplied with support for special releases.

Shunt closing release - YC (1a)

		1SDA...R1
E2/6	24V DC	038296
E2/6	30V AC / DC	038297
E2/6	48V AC / DC	038298
E2/6	60V AC / DC	038299
E2/6	110...120V AC / DC	038300
E2/6	120...127V AC / DC	038301
E2/6	220...240V AC / DC	038302
E2/6	240...250V AC / DC	038303
E2/6	380...400V AC	038304
E2/6	440...480V AC	038305

Note: the shunt opening (YO) and closing (YC) releases are constructionally identical and therefore interchangeable. Their function is linked to the assembly position on the circuit-breaker.

SOR Test Unit - (1b)

		1SDA...R1
E2/6		050228

Undervoltage release - YU (2a)

		1SDA...R1
E2/6	24V DC	038306
E2/6	30V AC / DC	038307
E2/6	48V AC / DC	038308
E2/6	60V AC / DC	038309
E2/6	110...120V AC / DC	038310
E2/6	120...127V AC / DC	038311
E2/6	220...240V AC / DC	038312
E2/6	240...250V AC / DC	038313
E2/6	380...400V AC	038314
E2/6	440...480V AC	038315



Ordering codes

Accessories for Emax



Electronic time-delay device for undervoltage release - D (2b)

		1SDA...R1
E2/6	24...30V DC	038316
E2/6	48V AC / DC	038317
E2/6	60V AC / DC	038318
E2/6	110...127V AC / DC	038319
E2/6	220...250V AC / DC	038320



Geared motor for automatic charging of the closing springs - M (3)

		1SDA...R1
E2/6	24...30V AC / DC	038321
E2/6	48...60V AC / DC	038322
E2/6	100...130V AC / DC	038323
E2/6	220...250V AC / DC	038324
E2/6	24...30V AC / DC + MC 24Vdc for digital signals	066050
E2/6	48...60V AC / DC + MC 24Vdc for digital signals	066051
E2/6	100...130V AC / DC + MC 24Vdc for digital signals	066052
E2/6	220...250V AC / DC + MC 24Vdc for digital signals	066053

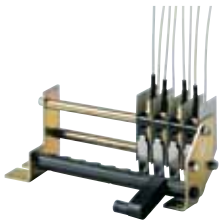
Note: supplied as standard with limit contact and microswitch to signal when the closing springs are charged (accessory 5d).

Overcurrent release trip indication - (4a)

		1SDA...R1
E2/6		058260

Electrical indication of overcurrent release trip by remote control - (4b)

		1SDA...R1
E2/6	220...240V AC/DC	058261
E2/6	110...130V AC/DC	058262
E2/6	24...30V AC/DC	058263



Electrical indication of circuit-breaker open/closed - Q1 ... 10 - (5a)

		1SDA...R1
E2/6 - PR111/VF	4 auxiliary contacts	038326 (a)
E2/6 - PR111/VF	4 auxiliary contacts for digital signals	050153
E2/6 - PR111/VF	10 auxiliary contacts (installed)	046523 (b)
E2/6 - PR111/VF	10 auxiliary contacts (not installed)	038327 (c)
E2/6 - PR111/VF	10 auxiliary contacts for digital signals	050152
E2/3 - PR122/VF	4 auxiliary contacts (2NO+2NC+2PR122/VF)	068801 (d)
E2/3 - PR122/VF	4 auxiliary contacts (2NO+2NC+2PR122/VF) for digital signals	068802
E2/3 - PR122/VF	10 auxiliary contacts (5NO+5NC+2PR122/VF - installed)	068803 (b)
E2/3 - PR122/VF	10 auxiliary contacts (5NO+5NC+2PR122/VF - not installed)	068804 (c)
E2/3 - PR122/VF	10 auxiliary contacts (5NO+5NC+2PR122/VF) for digital signals	068805
E2/6 MS	4 auxiliary contacts	038326
E2/6 MS	4 auxiliary contacts for digital signals	050153
E2/6 MS	10 auxiliary contacts	038327
E2/6 MS	10 auxiliary contacts for digital signals	050152

Note: (a) Already included with automatic circuit-breakers with PR111/VF. Can only be ordered as loose accessories.
 (b) Can only be ordered mounted with automatic circuit-breakers.
 (c) Can only be ordered loose in the case of automatic circuit-breakers.
 (d) Already included for circuit-breakers with PR122/VF. Can only be ordered as loose accessories.

Additional external electrical indication of circuit-breaker open/closed - Q11 ... 25 - (5b)

		1SDA...R1
E2/6	15 additional auxiliary contacts (version for fixed/ withdrawable racked-in)	043475 (a)
E2/6	15 additional auxiliary contacts (version for withdrawable racked-in/ test)	048827
E2/6	15 additional auxiliary contacts for digital signals (version for fixed/withdrawable racked-in)	050145 (a)
E2/6	15 additional auxiliary contacts for digital signals (version for withdrawable racked-in/ test)	050151

Note: Outside the circuit-breaker. To be requested in alternative to the different types of interlocks (accessory 10) and to the mechanical compartment door lock (accessory 8f).
(a) For fixed version, also request the interlock plate (accessory 10.4).

Electrical indication of circuit-breaker racked-in/isolated test/isolated S75 - (5c)



		1SDA...R1
		3 poles
E2/6	5 auxiliary contacts	038361
E2	10 auxiliary contacts	038360
E3	10 auxiliary contacts	043468
E4-E6	10 auxiliary contacts	043470
E2/6	5 auxiliary contacts for digital signals	050146
E2	10 auxiliary contacts for digital signals	050147
E4-6	10 auxiliary contacts for digital signals	050147
E3	10 auxiliary contacts for digital signals	050149

Signalling contact for closing springs charged S33 M/2- (5d)

		1SDA...R1
E2/6		038325

Note: already supplied with the geared motor for automatic charging of the closing springs.
Incompatible with PR120/D-M if the geared motor is not present.

Contact for signalling undervoltage release de-energised - (5e)

		1SDA...R1
E2/6	1 normally closed contact	038341
E2/6	1 normally open contact	038340

Ordering codes

Accessories for Emax

Mechanical accessories

Mechanical operation counter - (7)

		1SDA...R1
E2/6		038345

Locks in open position - (8a-8b)

with key (8a)

E2/6	for 1 circuit-breaker (different keys)	058271
E2/6	for groups of circuit-breakers (same keys N.20005)	058270
E2/6	for groups of circuit-breakers (same keys N.20006)	058274
E2/6	for groups of circuit-breakers (same keys N.20007)	058273
E2/6	for groups of circuit-breakers (same keys N.20008)	058272
E2/6	for groups of circuit-breakers (same keys N.20009)	064503

with padlocks (8b)

E2/6	ø 4 mm	038351 (a)
E2/6	ø 8 mm	064504

Note: (a) to be requested in alternative to the opening and closing pushbutton protection (accessory 9a).

Circuit-breaker lock in racked-in/test/racked-out position - (8c)

		1SDA...R1
E2/6	for 1 circuit-breaker (different keys and with padlocks Ø 4mm)	058278
E2/6	for groups of circuit-breakers (same keys N.2005 and with padlocks Ø 4mm)	058277
E2/6	for groups of circuit-breakers (same keys N.2006 and with padlocks Ø 4mm)	058281
E2/6	for groups of circuit-breakers (same keys N.2007 and with padlocks Ø 4mm)	058280
E2/6	for groups of circuit-breakers (same keys N.2008 and with padlocks Ø 4mm)	058279
E2/6	for groups of circuit-breakers (same keys N.2009 and with padlocks Ø 4mm)	064505
E2/6	for 1 circuit-breaker (same keys N.2009 and with padlocks Ø 6mm)	064506
E2/6	for groups of circuit-breakers (same keys N.2005 and with padlocks Ø 6mm)	064507
E2/6	for groups of circuit-breakers (same keys N.2006 and with padlocks Ø 6mm)	064508
E2/6	for groups of circuit-breakers (same keys N.2007 and with padlocks Ø 6mm)	064509
E2/6	for groups of circuit-breakers (same keys N.2008 and with padlocks Ø 6mm)	064510
E2/6	for groups of circuit-breakers (same keys N.2009 and with padlocks Ø 6mm)	064511

Padlocks

		1SDA...R1
E2/6	Ø 8mm	064512

Preset for key lock

		1SDA...R1
RONIS		
Cap preset		058315
Lock in open position		058276
Lock in racked-in/test/racked-out position		058314
CASTELL		
Lock in open position		058275

Accessory for lock in test/racked-out position - (8d)

		1SDA...R1
E2/6		038357

Note: to be requested for completion of the circuit-breaker lock in racked-in / test / racked-out position (accessory 8c)

Accessory for shutter padlock lock - (8e)

		1SDA...R1
E2/6		038363

Mechanical compartment door lock - (8f)

		1SDA...R1
E2/6		045039

Note:

- to be requested with interlock for fixed circuit-breaker/moving part of withdrawable circuit-breaker (accessory 10.2)
- for fixed version, also request interlock plate 10.4
- to be ordered in alternative to the cable interlocks (accessory 10.1), and in alternative to the 15 additional auxiliary contacts (accessory 5b).



Opening and closing pushbutton protection - (9a)

		1SDA...R1
E2/6		038343

Note: to be requested in alternative to the lock with padlocks in open position (accessory 8b).

IP54 Door protection - (9b)

		1SDA...R1
E2/6	Different keys	038344
E2/6	Same keys	065622

Protection for sealable relay - (9c)

		1SDA...R1
E2/6 - PR111/VF		048721
E2/3 - PR122/VF		058317

Mechanical interlock - (10)

10.1 Interlock cables for fixed circuit-breakers or fixed parts

		1SDA...R1
E2/6	A - horizontal	038329
E2/6	B - horizontal	038330
E2/6	C - horizontal	038331
E2/6	D - horizontal	038332
E2/6	A - vertical	038333
E2/6	B - vertical	038334
E2/6	C - vertical	038335
E2/6	D - vertical	038336

Note: request one type of cable for each interlock. To be requested on one of the fixed circuit-breakers or on one of the fixed parts.

10.1 Extended interlock cables for fixed circuit-breakers or fixed parts

E2/6	A - horizontal extended cables	066090
E2/6	B - horizontal extended cables	066091
E2/6	C - horizontal extended cables	066092
E2/6	D - horizontal extended cables	066093
E2/6	A - vertical extended cables	066094
E2/6	B - vertical extended cables	066095
E2/6	C - vertical extended cables	066096
E2/6	D - vertical extended cables	066097

Note: request one type of cable for each interlock. To be requested on one of the fixed circuit-breakers or on one of the fixed parts.

10.3 Interlock for fixed circuit-breaker/moving part of withdrawable circuit-breaker

		1SDA...R1
		3 poles
E2		038366
E3		038367
E4		038368
E6		043466

Note: request an accessory for each fixed circuit-breaker/moving part of withdrawable circuit-breaker.

10.4 Interlock for fixed circuit-breaker/fixed part of withdrawable

E2/6	Interlock A / B / D	038364
E2/6	Interlock C	038365

Note: request an accessory for each fixed circuit-breaker/moving part of withdrawable circuit-breaker.

10.5 Interlock plate for fixed circuit-breaker

E2/6		038358
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Note: only request for fixed circuit-breaker.

Ordering codes

Accessories for Emax

Auxiliary units



Test and programming unit

		1SDA...R1
E2/6 - PR111/VF	PR010/T	048964
E2/6 - PR111/VF	Ekip TT - Trip Test Unit	066988
E2/3 - PR122/VF	Ekip T&P	066989

PR120/K indication module

		1SDA...R1
E2/3 - PR122/VF	PR120/K (4 Outputs with independent terminals)	058255
E2/3 - PR122/VF	PR120/K (4 Outputs + 1 Input with one terminal in common)	058256



PR120/D-M (Modbus RTU) communication module

		1SDA...R1
E2/3 - PR122/VF	PR120/D-M	058254

BT030-USB

		1SDA...R1
E2/3 - PR122/VF	BT030-USB	058259

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