Low Voltage
Air Circuit Breaker

800A-6300A,1000V
40kA-150kA

SQelectric air circuit breaker

an innovative user friendly circuit breaker
with microprocessor control unit for protection
and measurements as standard
suitable for all applications in:

> Industry
> Infrastructures
> Constructions
> Utility

SQ electric

Air Circuit Breaker

Presentation

SQelectric air circuit breakers are designed and made incorporating universal control unit STR45D having protection, control & measurement functions. They may be installed in main LV switchboards as incoming units, main and secondary outgoings. SQelectric acb offers a complete range with a large selection of performance level:

- ratings from 800 to 6300 A AC,
- breaking capacity from 40 to 100 kA rms;
- operational voltages 690V AC 1000V DC

SQelectric circuit breakers are equipped with microprocessor-based electronic control units. All the protection functions are powered by the AC system and no auxiliary power supply is required. The same is true for most of the complementary functions.

STR45D control units measure the true rms value of the current and are therefore not affected by harmonics that may be present on the system.

SQelectric circuit breakers comply with all the major international standards:

- International standard IEC 947-2 They also comply with the following national standards:
- Germany VDE 0660
- United Kingdom BS 4752
- Italy CEI

SQelectric circuit breakers comply with the specifications of the marine classification companies

Tropicalisation

As standard, SQelectric circuit breakers are designed for tropical conditions with 95% relative humidity at 45ºC or 80% at 55ºC, hot and humid climate conditions. They also comply with the following standards:

* IEC 68-2-30 damp heat
* IEC 68-2-2 dry heat
* IEC 68-2-11 salt spray
* IEC 68-2-1 low temperatures during storage.

Corrosive atmospheres: Special grease or other surface coatings available (please consult us).

Operating safety

The insulating casing of SQelectric circuit breakers provides for:

- user safety:
  - double insulation on the front face (class II)
  - auxiliary circuits in a compartment insulated from the power circuits
- switchboard safety when the circuit breaker is in the open position
  - each pole is effectively isolated in its own housing
  - limitation of external disturbances

Positive contact indication

The position indicator cannot indicate "open" unless the poles are effectively separated by the required distance.
The circuit breakers automatically open during racking in and out.

reliability

- SQelectric circuit breakers comprise ten times fewer parts than traditional devices. They are easier to produce and more reliable.
- the design of SQelectric circuit breakers is modular with delayed differentiation (highest possible number of common parts on all models). The result is shorter delivery times and enhanced reliability.

Air Circuit Breaker

Ease of installation

SQelectric is a complete and rationally designed range.

- 10 ratings;
- wide breaking-capacity levels;
- 1 control units covers all the protection & measurement functions
- a complete range of auxiliaries and accessories;
- numerous versions (three and four-pole devices, fixed and drawout versions, etc.).

SQelectric circuit breakers are easy to incorporate in switchboards

- a single frame size from 800 to 3200 A, thus making for standardised columns;
- an upper safety clearance equal to zero due to the arc-chute cover, on both the fixed and drawout versions;
- built-in measurement functions in the control units;
- auxiliaries are the same for the entire range and may be easily implemented (only a screwdriver is required).

SQelectric circuit breakers are easy to connect to the main distribution system.

- all types of connections are available (horizontal and vertical terminals, front and mixed connections);
- connections are possible with bars of any thickness
- connection to the input power source is possible on the upper or lower terminals of the circuit breakers.

Due to their small size, SQelectric circuit breakers can replace most existing circuit breakers.

maximum dependability

all SQelectric circuit breakers are also disconnectors (suitable for isolation) as specified by IEC 947-2. They bear the corresponding symbol on the front cover:

This characteristic considerably increases the dependability of the circuit breaker.

The conditions specified by IEC 947.2 for this function are:

- positive contact indication;
- impulse withstand; 8kV at sea level;
- very low leakage current, checked on new circuit breakers and on circuit breakers subjected to tests representative of the end of service life.

Moreover SQelectric circuit breakers have a double-insulation front face (i.e.a class II device) allowing control from the outside.

installation

SQelectric circuit breakers may be installed on horizontal metal surfaces or on rails. They are secured by four points accessible at the bottom of the chassis (drawout versions) or on either side of the circuit breaker (fixed versions.) A single door cut-out is required for the entire range and provides access to SQelectric controls.

Standards

IEC 947-2

This standard provides the user with a better guarantee concerning quality and performance.

Circuit breakers are subjected to tests that are more representative of real operating conditions.

Definition of the terms breaking capacity:

IEC947-2 also clarifies the notion of breaking capacity.

- **Icu:** the ultimate breaking capacity, which must be greater than or equal to the 3-phase short-circuit current at the point of installation of the circuit breaker, a value unlikely to be reached under real conditions;
- **Ics:** the service breaking capacity, generally expressed as a percentage of the ultimate breaking capacity (25,50,75 or 100% of Icu). It corresponds to a short-circuit current that is more likely to be reached under real conditions. The circuit breaker must continue to operate normally after having interrupted a current equal to Ics several times;
- **Icw:** short-time withstand current for circuit breakers belonging to category B (category B refers to circuit breakers with time discrimination and category A to those without time discrimination).

Furthermore, IEC947-2 takes into account recent technological advances:

- suitability for isolation recognised for circuit breakers having passed special electrical and mechanical test:
- industrial earth-fault circuit breakers covered by an appendix;
- definition of tests designed to ensure coordination between two circuit breakers.

Air Circuit Breaker

control unit		STR45D					
type of circuit breaker		SQelectric acb					
basic protection							
long time protection LT		■					
adjustable current setting (Ir) in 2% steps	Ir = In x ...	0.4 to 1					
tripping range		between 1.05 and 1.20 x Ir					
time delay (tr)		adjustable					
accuracy :+0 -20%	tr at 1.5 Ir (s)	15	30	60	120	240	480
	tr at 6 Ir (s)	0.94	1.88	3.75	7.50	15	30
	tr at 7.2 Ir (s)	0.65	1.30	2..60	5.20	10	21
short time protection ST		■					
adjustable pick-up (Im) in 4% steps	Im = Ir x ...	0.4 to 15 ± 10%					
time delay (tr)	tm setting with I^2t OFF	0.09	0.18	0.27	0.36		
	tm setting with I^2t ON	0.09	0.18	0.27	0.36		
	max. overcurrent time before tripping (ms)	60.9	140.9	230.9	350.9		
	max. break time (ms)	140.9	230.9	350.9	500.9		
Instantaneous protection I		■					
fixed pick-up I (kA)		S08 to S16 : 65. S20 to S63: 75.					
pick-up (I) adjustable in 8% steps		from In to fixed pick-up (mini at 1.6 kA)					
accuracy		± 15%					
OFF switch on front face		on types N1 and H1					
basic functions							
fault indication							
for tripping on a fault	button on front face	■					
	fault trip alarm contact	■					
for Ir setting overrun	LED on front face	■					
	self powered	■					
indication of fault type	LEDs on front face	■					
and value of interrupted current	display on ammeter	■					
self-monitoring	internal overheating and microprocessor errors	■					
self-powered		■					
integrated test		■					

electrical operating mechanism

Added to the manual charging mechanism, a motor charges and automatically recharges the stored-energy spring upon breaker closing making possible fast O-C-O cycles
Opening and closing operations are instantaneous.
The manual mechanism remains available for emergency use.

The electrical operating mechanism includes:

- the gear motor
- a closing release
- a shunt release or an undervoltage release for opening;
- "springs charged" limit switch changeover contact

The addition of the electrical operating mechanism does not alter circuit breaker dimensions.

characteristics		geared motor
power supply	50/60 Hz (V)	100/127 - 200/240 - 250/277 - 380 - 415 - 440 - 480
	consumption (VA)	180
	DC (V)	24/30 - 48/60 - 100/125 - 200/250
	consumption (W)	180
motor start-up surge		2 to 3 In for 0.1 s
charging time		3 to 4 s

Air Circuit Breaker

Protection

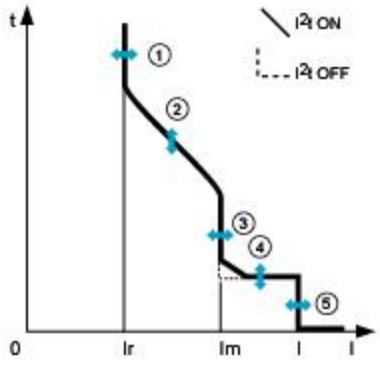
The STR45D control unit is used as standard for protection, measurement and supervision functions. The liquid crystal display and function keys ensure high accuracy and easy adjustment. The standard STR 45 D control unit provides the following:

- universal protection for overcurrent, short circuit & earth faults with different level & adjustable characteristics
- ammeter function
- voltage measurement
- indication of fault type
- values of interrupted currents
- integrated on-load test, trip/no trip conditions.

The STR45D control unit provides:

- **overload protection,** with long time Protection LT including:
  - adjustable time delay and thermal memory possibility
- **short-circuit protection:**
  - delayed, with short time function ST, for which the I^2t curve can be disabled by the user,
  - instantaneous, with the INST function that can be disabled by the user
- **"earth" protection** with time discrimination or zone selective interlocking. The protection is of the residual current type (or source ground return type on request).

Basic functions: long time LT, short time ST, instantaneous INST



overcurrent settings
1 : LT setting Ir (long time)
2 : LT time delay tr (long time)
3 : ST pick-up Im (short time)
4 : ST time delay tm (short time)
5 : INST pick-up I (instantaneous)

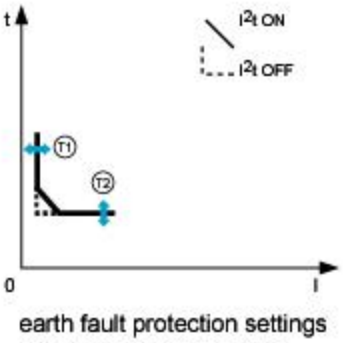
indication and measurement

a digital display continuously indicates the current of the phase with the greatest load (Imax) and Voltages. By pressing a scroll button, it is also possible to display successively the readings of I_1, I_2, I_3 & voltage in phases. The display unit also helps setting parameters related to protections & measurement of the programmable control unit.

Factory adjustments
The STR45D control unit is factory adjusted as follows:

LT	setting Ir		In
	time delay tr		480 s
ST	pick-up Im		4 In
	time delay tm		0,2 s
INST	pick-up I		maxi
T	earth fault pick-up Ih		0.2 In
	time delay th		0,1 s
	load monitor	Ic1	In
		Ic2	In

Earth fault protection (option T)



earth fault protection settings
T1 : earth fault pick-up Ih
T2 : earth fault time delay th

earth fault protection

This earth fault protection is designed to protect the installation against the risks of fire due to high earth faults (not to be confused with schemes designed for the protection of persons against electrical shock).

Two types of earth protection are available for SQelectric:

- residual current type (T): the control unit calculates the vector sum of the phase and neutral (if distributed) currents
- source ground return type (W): the control unit acts directly on the signal received from an external current transformer installed on the source earthing circuit.

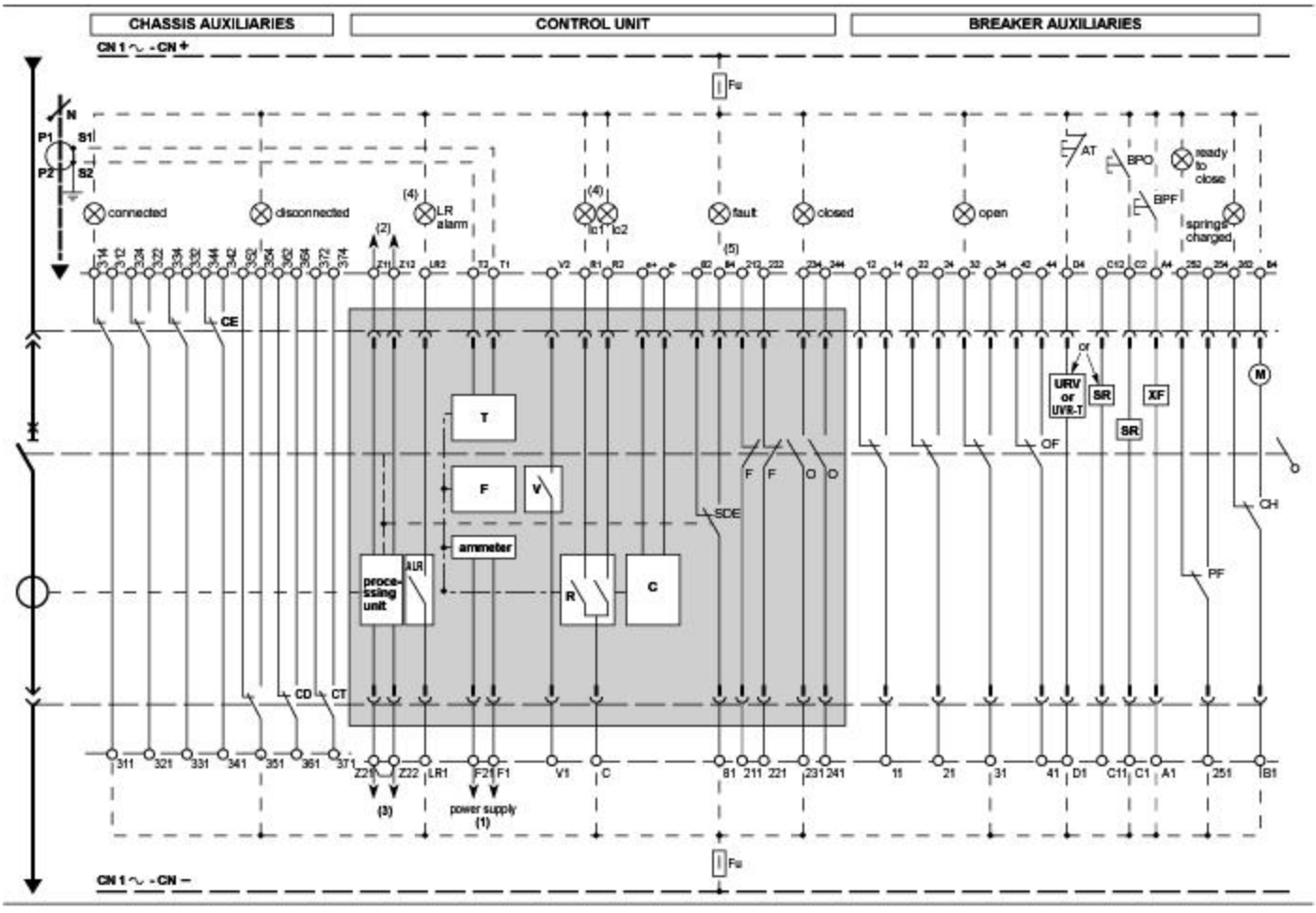
Air Circuit Breaker

SQelectric circuit breakers				S08		S10		S12	
number of poles				3-4		3-4		3-4	
electrical characteristics as per IEC 947-2 and EN 60947-2									
rated current (A)	In	40°C		800		1000		1250	
rating of 4th pole (A)				800		1000		1250	
rated insulation voltage (V)	Ui			1000		1000		1000	
rated impulse withstand voltage (V)	Uimp			8000		8000		8000	
rated operational voltage (V)	Ue	AC 50/60 Hz		690		690		690	
type of circuit breaker				**H1**	**H2**	**H1**	**H2**	**H1**	**H2**
ultimate breaking capacity (1)	Icu	AC 50/60 Hz	220/415 V	65	100	65	100	65	100
(kA rms)			500/690 V	65	85	65	85	65	85
service breaking capacity	Ics	(% Icu)		100%	100%	100%	100%	100%	100%
short - time withstand current	Icw	AC 50/60 Hz	0.5 s	65	65	65	65	65	65
(kA rms)			1 s	50	50	50	50	50	50
			3 s	32	32	32	32	32	32
making capacity (kA peak)	Icm	AC 50/60 Hz	220/415 V	143	220	143	220	143	220
			440 V	143	220	143	220	143	220
			500/690 V	143	187	143	187	143	187
electrodynamic withstand (kA peak)				143	143	143	143	143	143
utilization category				B		B		B	
suitability for isolation				■		■		■	
break time				25 to 35 ms					
closing time				75 ms					
endurance (C-O cycles) x 1000	mechanical	with maintenance		20	20	20	20	20	20
		no maintenance		10	10	10	10	10	10
	electrical	no maintenance	440 V - In	10	10	10	10	10	10
			690 V - In	10	10	10	10	10	10
	motor control (AC3-947-4) (2)		690 V	10	10	10	10	10	10
installation and connections									
connection				front and rear connections					
version	drawout			■		■		■	
	fixed			■		■		■	
indication and measurement auxiliaries									
auxiliary switches				■		■		■	
electronic trip unit related functions				■		■		■	
control auxiliaries									
auxiliary releases				■		■		■	
motor mechanism				■		■		■	
operation counter				■		■		■	
installation and connection accessories									
interphase barriers				■		■		■	
terminal - block cover				■		■		■	
door frame				■		■		■	
dimensions and weights									
dimensions W x H x D (mm)	drawout		3P	290x400x312		290x400x312		290x400x312	
			4P	550x439x367		550x439x367		550x439x367	
	fixed		3P	290x400x312		290x400x312		290x400x312	
			4P	537x356x290		537x356x290		537x356x290	

Air Circuit Breaker

S16		S20		S25		S32		S40		S50		S63	
3-4		3-4		3-4		3-4		3-4		3-4		3-4	
1600		2000		2500		3200		4000		5000		6300	
1600		2000		2500		3200		4000		2500		3200	
1000		1000		1000		1000		1000		1000		1000	
8000		8000		8000		8000		8000		8000		8000	
690		690		690		690		690		690		690	
H1	H2	H1	H2	H1	H2	H1	H2	H1	H2	H1	H2	H1	H2
65	100	75	100	75	75	75	100	75	100	100	150	100	150
65	85	75	85	75	85	75	85	75	85	85	85	85	85
100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
65	65	75	75	75	75	75	75	75	75	100	100	100	100
50	50	75	75	75	75	75	75	75	75	100	100	100	100
32	32	57	57	75	75	75	75	75	75	100	100	100	100
143	220	165	220	165	220	165	220	165	220	220	330	220	330
143	220	165	220	165	220	165	220	165	220	220	330	220	330
143	187	165	187	165	187	165	187	165	187	187	187	187	187
143	143	165	165	165	165	165	165	165	165	220	220	220	220
B		B		B		B		B				B	
■		■		■		■		■		■		■	
20	20	15	15	15	15	15	15	10	10	10	10	10	10
10	10	10	10	10	10	10	10	5	5	5	5	5	5
10	10	9	9	8	8	4	4	3	3	3	3	2	2
10	10	7	7	6	6	2.6	2.6	2.5	2.5	2.5	2.5	1.5	1.5
10	10	7	7	6	6	2.6	2.6	2.5	2.5	2.5	2.5	1.5	1.5
								rear connections					
■		■		■		■		■		■		■	
■		■		■		■		■		■ (3P only)		■	
■		■		■		■		■		■		■	
■		■		■		■		■		■		■	
■		■		■		■		■		■		■	
■		■		■		■		■		■		■	
■		■		■		■		■		■		■	
■		■		■		■		■		■		■	
■		■		■		■		■		■		■	
■		■		■		■		■		■		■	
290x400x312		290x400x312		290x400x356		290x400x370		290x400x370		290x400x370		290x400x370	
550x439x367		550x439x367		550x439x367		550x439x367		550x439x367		550x439x367		550x439x367	
290x400x312		290x400x312		290x400x356		290x400x370		290x400x370		290x400x370		290x400x370	
537x356x290		537x356x290		537x356x290		537x356x290		537x356x290		537x356x290		537x356x290	

SQelectric : connection wiring diagrams



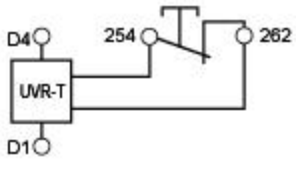
AT : emergency off
BPO : "open" pushbutton
BPF : "close" pushbutton
LR : long time trip (LT) indicating lamp
CR : short time trip (ST) indicating lamp
T : earth fault trip indicating lamp
CE : "connected" position contact (10A/240V AC)
M : spring charging motor (180V A/240V AC)
R : load monitoring and control
XF : closing release (20V A/240V AC)
T : earth fault protection (EZ and SZ: input and output for zone selective interlocking)
SR : shunt release (20V A/ 240V AC)
UVR : undervoltage release (20V A/240V AC)
UVR-T: time delayed undervoltage release (20V A/240V AC)
OF : auxiliary changeover contacts (10A/240V AC)
O : 2 auxiliary NC contacts (10A/ 240V AC)
F : 2 auxiliary NC contacts 10A/ 240V AC)
FTIC : fault trip indication contact (10A/ 240V AC)
CMS : charging motor limit switch contact
F : fault trip local indicator
FV : segregated fault trip indication contact (5A/ 240V AC)
PF : "ready to close" contact (10A/ 240V AC) (closing possible if breaker is open, not locked and operating mechanism charged)

CD : "disconnected" position contact (10A/ 240V AC)
CT : test position contact (10A/ 240V AC)
C : communication.

- Ic1: load shedding command according to Ic1 setting
  Ic2: load shedding command according to Ic2 setting
- diagram shown with circuits deenergised, breaker open and in "connected" position, springs charged and relays in released position
- accessories such as pushbuttons, lamps and fuses are not supplied with the circuit breaker.

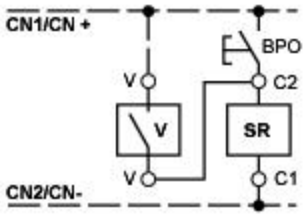
(1) Power supply terminals for I or T or F options (AD module with BAT battery module for backup power).
(2) Zone selective interlocking with line side breaker.
(3) Zone selective interlocking with load side breaker (remove jumper)
(4) DC power supply R contacts reset request wiring of an external contact
(5) With Z and/ or C options, terminal 84 is not available.

Wiring of the UVR-T (modified diagram). Instantaneous tripping with UVR-T when contact 254-262 opens.



Note: the wiring of the external contact replaces the spring charged indication and the contact PF.

V contact wiring:
for breaker locking, depending on the selected fault.

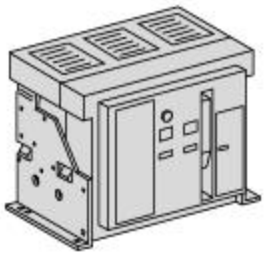


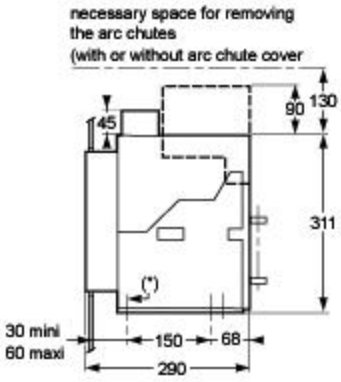
Selective locking needs:
* external power supply (F1, F2)
* an additional terminal (BS)

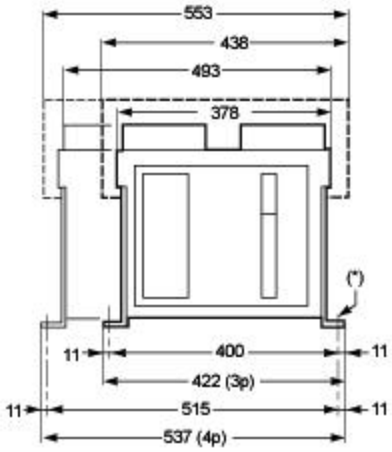
Fixed circuit breakers S08 to S32

dimensions

3 or 4 poles

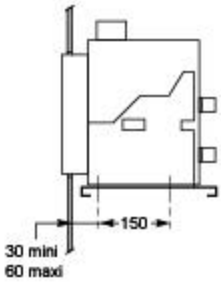




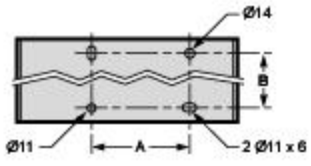


mounting

on a base plate

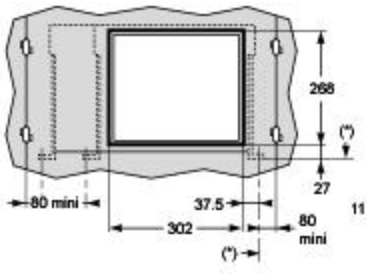


mounting detail

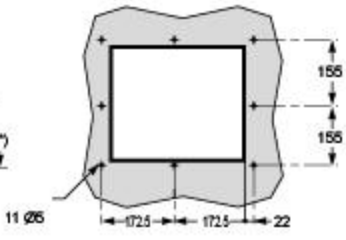


	3 poles	4 poles
A	150	150
B	400	515

Panel cut-outs



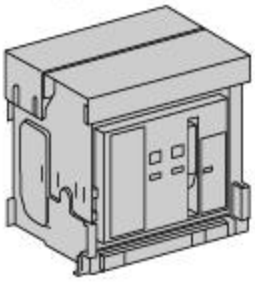
holes for escutcheon

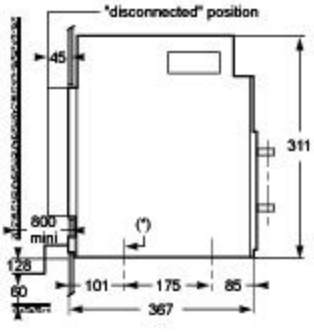


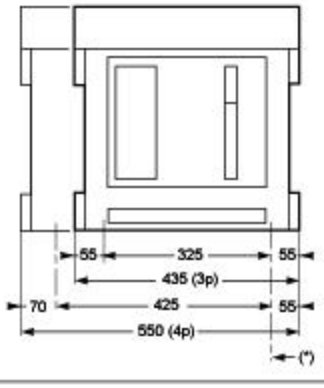
Drawout circuit breakers S08 to S32

dimensions

3 or 4 poles

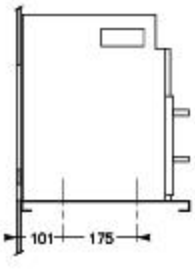




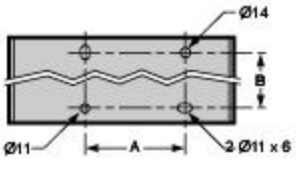


mounting

on a base plate

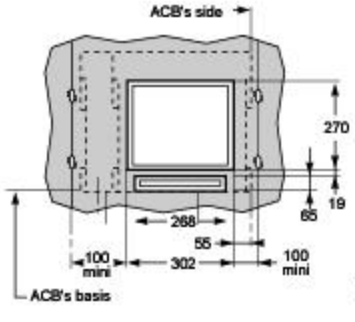


mounting detail

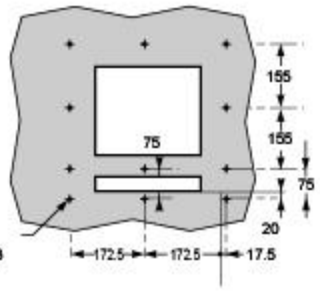


	3 poles	4 poles
A	175	175
B	325	425

Panel cut-outs



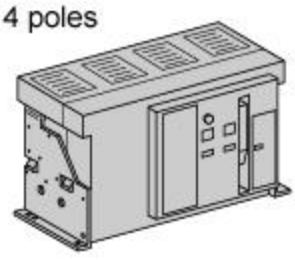
holes for escutcheon

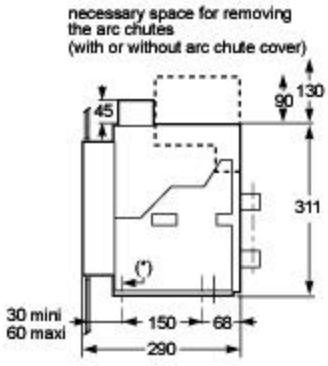


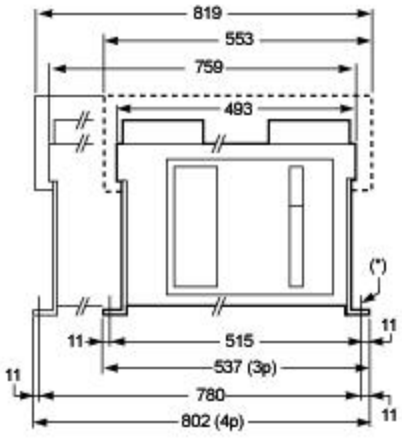
Fixed circuit breaker S40

dimensions

3 or 4 poles

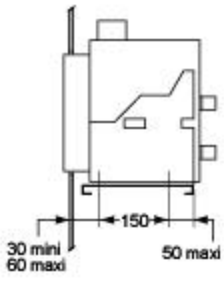




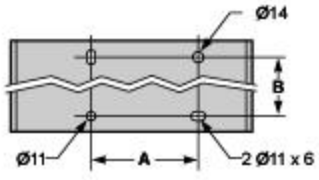


mounting

on a base plate

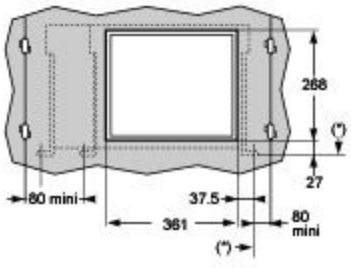


mounting detail

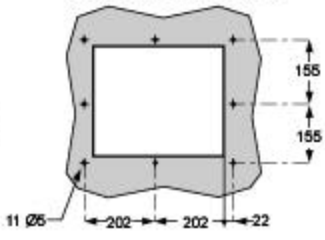


A	150	150
B	515	780

Panel cut-outs



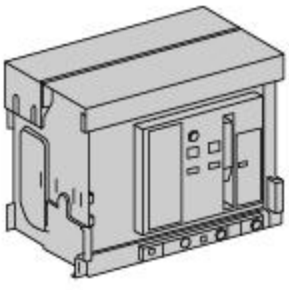
holes for escutcheon

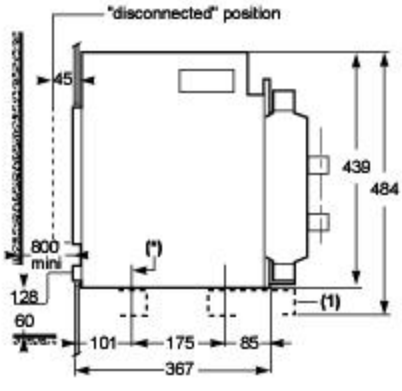


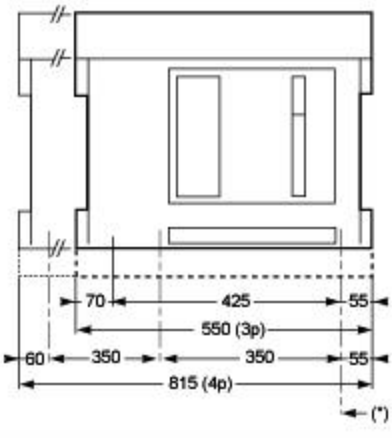
Drawout circuit breaker S40

dimensions

3 or 4 poles

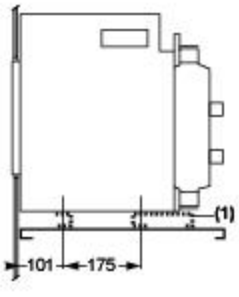




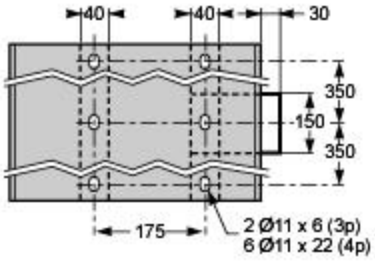


mounting

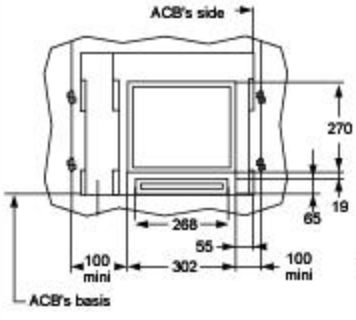
on a base plate



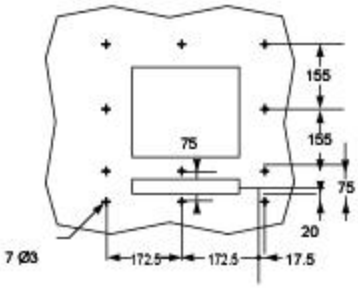
mounting detail



panel cut-outs



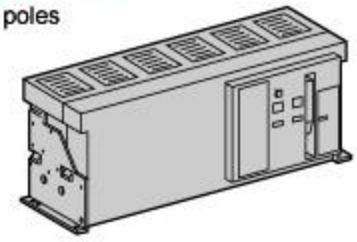
holes for escutcheon

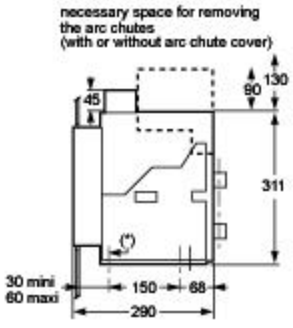


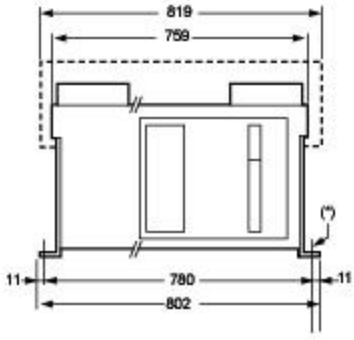
Fixed circuit breaker S50-63

Dimension

3 poles

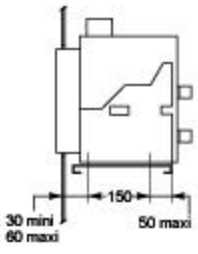




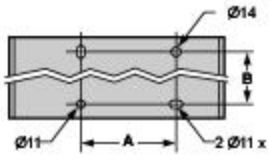


mounting

on a base plate

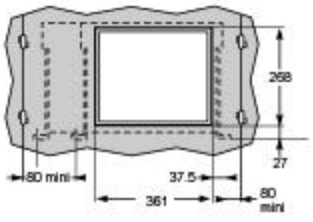


mounting detail

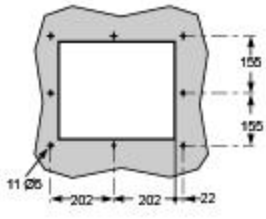


	3 poles	
A	150	
B	780	

panel cut-outs



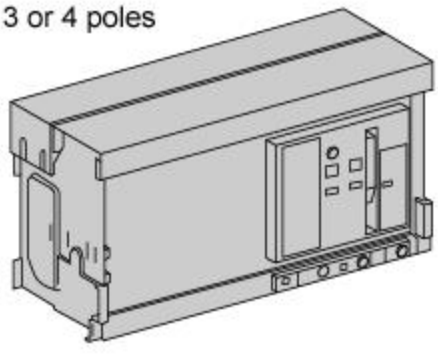
holes for escutcheon

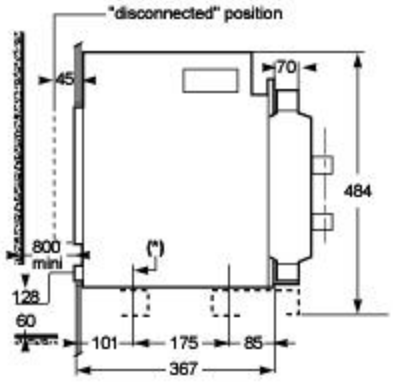


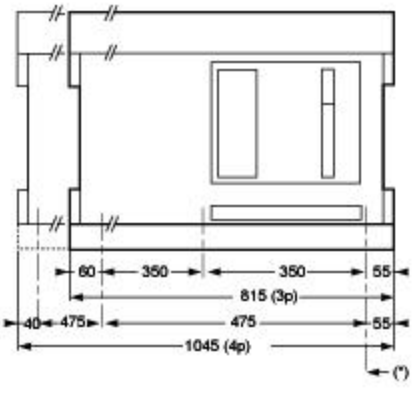
Drawout circuit breaker S50-63

dimensions

3 or 4 poles

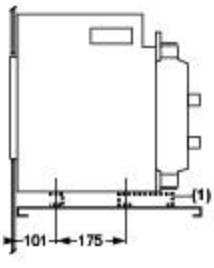




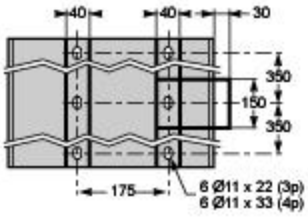


mounting

on a base plate

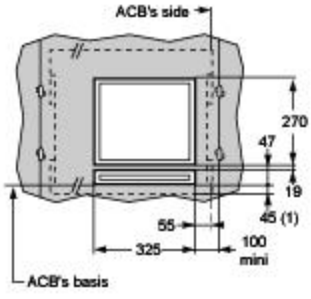


mounting detail



panel cut-outs

panel cut-outs



holes for escutcheon