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TECHNICAL CATALOG

## **SACE FORMULA DSA UL/CSA**

Low voltage molded-case circuit-breakers up to 250A  
UL489 and CSA C22.2 Standards



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**SACE FORMULA DSA is a result of ABB SACE long history of developing effective circuit-breakers. It was developed to be simple, but amazes with its extreme quality and versatility.**

# **SACE FORMULA DSA UL/CSA**

## The complete offering





# Main characteristics

- 1/2** **SACE FORMULA DSA overview and distinctive features**
- 1/4** **Products conformity**
- 1/5** **Construction characteristics**
- 1/5** Identification of the SACE FORMULA DSA circuit-breakers
- 1/6** General information

# SACE FORMULA DSA overview and distinctive features

## Simplicity and quality in a single product

SACE FORMULA DSA range is the outcome of ABB SACE long history providing effective circuit-breakers. It was developed to be simple but amazing with its extreme quality and versatility.

The highlights of SACE FORMULA DSA range of molded case circuit-breakers include:

- Quick and easy selection and ordering with few, but essential, versions of circuit-breakers
- Multiple polarities, dedicated to various applications
- Accompanying accessory line
- Reduced circuit-breaker depths

The SACE FORMULA DSA range consists of two frames, A1 and A2, which reach up to 100 A and 250 A respectively. Both frames are available in the fixed version with front terminals.

The protection trip unit has fixed thermal and magnetic threshold values to put the circuit-breaker into service more rapidly. A reduced number of product codes simplifies selection and makes ordering easier. Installation is easy and the circuit-breaker is ready for immediate use.



**The easy and precise choice**

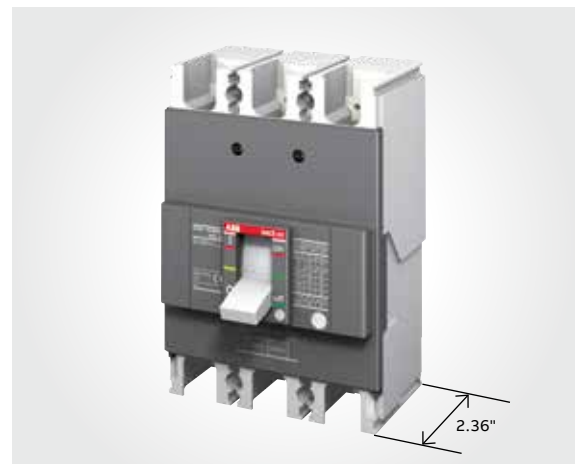
How simple and functional can a range of molded case circuit-breakers be? By asking this elementary question, ABB conceived the idea of this family of circuit-breakers. The result is SACE FORMULA DSA, the perfect synthesis between ABB SACE recognized quality, reliability and simplicity, mainly about installation, sizing and fitting of accessories.

Reducing dimensions without compromising performance and reliability is an ABB SACE trademark that helps with installation and increases the work space inside switchboards and panels. SACE FORMULA DSA compact design is a great advantage, especially for OEMs, panel builders and installers.

**Quality in all applications**

Quality is versatility. ABB offers both three-pole and two-pole versions up to 250 A, along with a single-pole version up to 100 A, opening the door to the most varied application fields.

Quality is compact overall dimensions. The SACE FORMULA DSA A1 and A2 depth of under 2.5" is one of the lowest in the market up to 250 A.



# Products conformity



Hologram

## Compliance with Standards

SACE FORMULA DSA circuit breakers and their accessories are manufactured in compliance with:

- Standards
  - UL 489 and CSA C22.2
  - PNS 519:1991 (for A1 100 In=100A 2p-3p only)
- Directives
  - EC "Low Voltage Directive" (LVD) 2014/35/EU
  - EC "Electromagnetic Compatibility (EMC) Directive" 2014/30/EC

Certification of conformity with the product Standards is carried out in the ABB SACE test lab (accredited by ACCREDIA - certificate no. 0062L-02/2020) in compliance with UNI CEI EN ISO/IEC 17025 European Standard, by the Italian certification body ACAE (Association for Certification of Electrical Apparatus), member of the European LOVAG organization (Low Voltage Agreement Group) and by the Swedish certification body SEMKO belonging to the international IECEE organization.

The SACE FORMULA DSA series has a hologram on the front, obtained using special anti-forgery techniques, as a guarantee of the quality and genuineness of the circuit-breaker as an ABB SACE product.

## Company quality system

The ABB SACE quality system complies with the following Standards:

- ISO 9001 International Standard
- EN ISO 9001 (equivalent) European Standards
- UNI EN ISO 9001 (equivalent) Italian Standards

The ABB SACE quality system attained its first certification with the RINA certification body in 1990.

## Environmental Health & Safety Management System, Social Responsibility and Ethics

Special care for the environment is a priority commitment for ABB SACE. This is confirmed through the company's Environmental Management System which is certified by RINA in compliance with the International ISO14001 Standard (ABB SACE was the first industry in the electromechanical sector in Italy to obtain this recognition). In 1999 the Environmental Management System was integrated with the Occupational Health and Safety Management System according to the OHSAS 18001 Standard and later, in 2005, with the SA 8000 (Social Accountability 8000) Standard. All this amounts to solid evidence of ABB's commitment to respecting business ethics and promoting a safe and healthy work environment.

ISO 14001, OHSAS 18001 and SA8000 recognitions together with ISO 9001 made it possible to obtain RINA BEST 4 (Business Excellence Sustainable Task) certification. In addition to this, the following markings and certifications have been achieved :

- GISA 01.02A03;
- LCA (Life Cycle Assessment).

The commitment to environmental protection becomes reality through:

- Selection of materials, processes and packaging that optimize the true environmental impact of the product
- Use of recyclable materials

## Product Material Compliance

The SACE FORMULA DSA family complies with the following international regulations:

- RoHS II, Directive 2011/65/EU and Amendment 2015/863 - Restriction of Hazardous Substances;
- REACH, 2006/1907/EC, Registration, Evaluation, Authorisation and Restriction of Chemicals;
- WEEE 2012/19/EU -Waste Electrical & Electronic Equipment;
- Conflict Minerals - Dodd-Frank Consumer Protection Act. Section 1502.

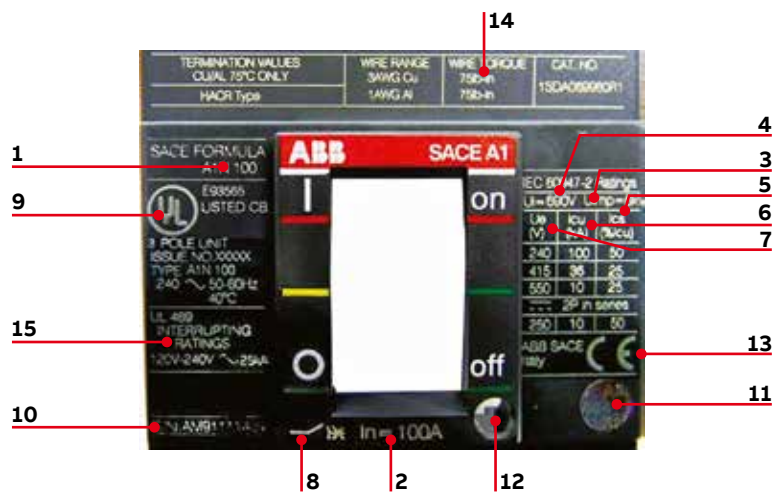


# Construction characteristics



## Identification of the SACE FORMULA DSA circuit-breakers

The characteristics of the circuit-breakers are given on the label on the front of the circuit-breaker and on the side label.

### Front label



### Side label

SACE FORMULA A2N 250			LR 54280				
9	<div></div> <div>E93565 LISTED C B 3 pole UNIT ISSUE NO. NS596 TYPE A2N250 240~50/60Hz 250V --- 40°C</div>			UL489		15	
				INTERRUPTING RATINGS 120V-240V~25kA 250V --- 25kA			
				ABB S.p.A, Via Pescaria, 5 24123 Bergamo Italy		13	
IEC 60947-2 Ratings			CE			3	
4	UI=600V Uimp=6KV			DC WIRING DIAGRAMS			
7	Ue (V)	Icu (kA)	Ics (%Icu)	<div></div>			
6	240	85	50				
	415	38	50				
	450	10	50				
--- 2P in series							5
	250	38	80				
SOR							
UVR							
AUX (SY+1Q)							
10	S/N: CA31018869						
Made in Italy by ABB SACE							
1SDA114317R1							
1SDA114317R1							

1. Name of the circuit-breaker and performance level
2. In: rated uninterrupted current\*
3. Uimp: rated impulse withstand voltage\*
4. Ui: insulation voltage\*
5. Ics: rated short circuit service breaking capacity\*
6. Icu: rated ultimate short circuit breaking capacity\*
7. Ue: rated service voltage\*
8. Symbol of isolation behavior\*
9. Reference Standard and file number
10. Serial number
11. Anti-forgery
12. Test pushbutton
13. CE Marking
14. Lug information
15. UL interrupting ratings

\* In compliance with IEC 60947-2 Standard

Construction characteristics

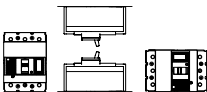
General information



Double insulation



Positive operation



Installation position



Test pushbutton

- All the molded case circuit-breakers in the SACE FORMULA DSA range are constructed in accordance with the following construction characteristics:
- Double insulation
  - Positive operation
  - Isolation behavior
  - Electromagnetic compatibility
  - Tropicalization
  - Reverse feedable power supply

**Versatility of the installation.** It is possible to mount the circuit-breaker in horizontal, vertical or lying down position without undergoing any derating of the rated characteristics.

**No nominal performance derating for use up to an altitude of 6562 ft.** Above 6562 ft., the properties of the atmosphere change (composition of the air, dielectric strength, cooling power and pressure), having an impact on the main parameters that define the circuit-breaker. The altitude table below gives the changes to the main performance parameters.

SACE FORMULA DSA circuit-breakers can be used in ambient temperatures between -25 °C to 70 °C (-13 °F to 158 °F) and stored in a room with atmospheric temperature between -40 °C to 70 °C (-40 °F to 158 °F).

All SACE FORMULA DSA circuit-breakers are fitted with a test pushbutton, which allows the release test to be performed. This test must be carried out with the circuit-breaker closed.

Altitude

		6600 ft.		8500 ft.		13000 ft.	
		A1	A2	A1	A2	A1	A2
Rated service voltage, Ue	(V)	240	240	228	228	192	192
Rated uninterrupted current	%	100	100	99	99	96	96

Weight

	A1 (lbs.)	A2 (lbs.)
Circuit-breaker 1-pole	0.54	–
Circuit-breaker 2-pole	1.04	1.61
Circuit-breaker 3-pole	1.54	2.43



# Circuit-breakers for power distribution

- 2/2**      **General characteristics**
- 2/3**      **Thermal-magnetic trip units**
- 2/4**      **Technical data**
- 2/5**      **Part number scheme**

## General characteristics

SACE FORMULA DSA circuit-breakers from 15 A to 250 A consist of the interruption component together with the trip unit and can be installed:

- Directly on the back plate of cubicles
- On a DIN rail

They are characterized by:

- Fixed version
- Polarity: 1-pole, 2-pole, 3-pole
- Maximum breaking capacity of 25 kA at 240V AC
- Fixed thermal-magnetic trip unit (TMF) for protection of networks in alternating current
- A single depth of 2.36"
- Standard front terminals

### SACE FORMULA DSA A1

- 01 1-pole
- 02 2-poles
- 03 3-poles
- 04 2-poles
- 05 4-poles



01



02



03

### SACE FORMULA DSA A2



04



05

Thermal-magnetic trip unit

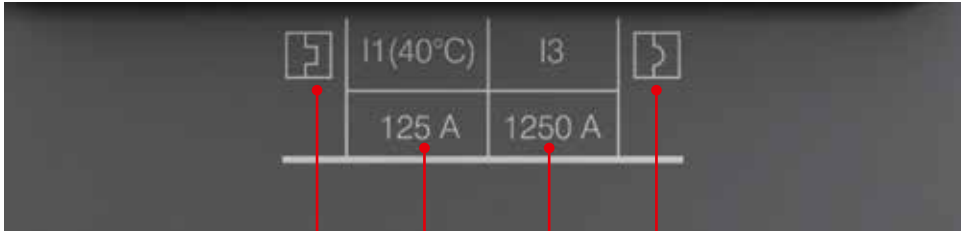
The thermal-magnetic trip units TMF, with fixed thermal and magnetic threshold, are generally used in power distribution plants.  
They allow protection against overloads due to the thermal device and protection against short circuit

due to the magnetic device:

- Thermal protection (L): fixed threshold  $I_1 = 1 \times I_n$ , with long inverse time trip curve
- Magnetic protection (I): fixed threshold  $I_3 = 10 \times I_n$ , with instantaneous trip curve

Fixed thermal-magnetic trip unit TMF

An example with SACE FORMULA DSA A2  $I_n = 125\text{ A}$



Thermal protection symbol

Thermal protection value

Magnetic protection symbol

Magnetic protection value

SACE FORMULA DSA A1 with trip unit TMF

TMF												
<div>L</div> <div><math>I_1 = 1 \times I_n</math></div>	$I_n\text{ (A)}$	15	20	25	30	40	50	60	70	80	90	100
	Neutral (A) — 100%	15	20	25	30	40	50	60	70	80	90	100
<div>I</div> <div><math>I_3 = 10 \times I_n</math></div>	$I_3\text{ (A)}$	300 <sup>1)</sup>	300 <sup>1)</sup>	300 <sup>1)</sup>	300 <sup>1)</sup>	400	500	600	700	800	900	1000
	Neutral (A) — 100%	300	300	300	600	400	500	600	700	800	900	1000

1) Single- and two-pole versions have an  $I_3$  (3) of 400.

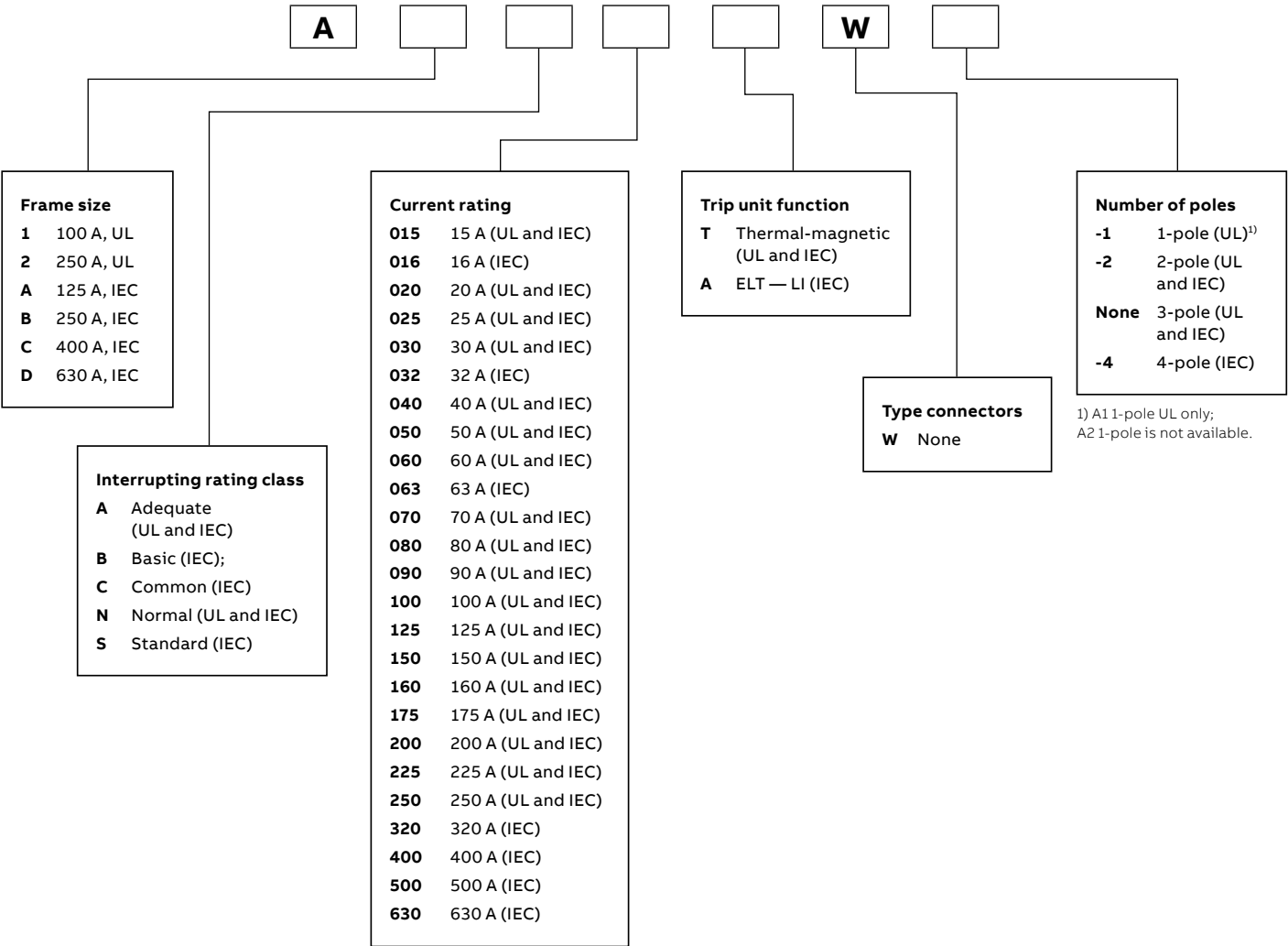
SACE FORMULA DSA A2 with trip unit TMF

TMF							
<div>L</div> <div><math>I_1 = 1 \times I_n</math></div>	$I_n\text{ (A)}$	125	150	175	200	225	250
	Neutral (A) — 100%	125	150	175	200	225	250
<div>I</div> <div><math>I_3 = 10 \times I_n</math></div>	$I_3\text{ (A)}$	1250	1500	1750	2000	2250	2500
	Neutral (A) — 100%	1250	1500	1750	2000	2250	2500

Technical data

					A1		A2	
Frame size	A	100					250	
Rated current, In	A	15–100					125–250	
Poles	No.	1, 2, 3					2, 3	
Rated service voltage, Ue (AC) 50–60 Hz (DC)	V	240 (1p, 2p, 3p) 125 (1p), 250 (2p,3p)					240 (2p, 3p) 250 (2p,3p)	
Versions						Fixed		Fixed
Performance Level				A	N		A	N
Pole	No.	1	2, 3	1	2, 3	2, 3		2, 3
Rated ultimate short circuit breaking capacity, Icu								
Interrupting rating at 240 V 50–60 Hz (AC)	kA	10	10	18	25	10	25	
Interrupting rating at 125 V (DC) 1-pole	kA	5	–	10	–	–	–	
Interrupting rating at 250 V (DC) 2-pole in series (2p, 3p)	kA	–	5	–	10	10	25	
Reference Standard	UL 489					UL 489		
Isolation behavior	Yes					Yes		
Mounting onto DIN rail	DIN EN 50022					DIN EN 50022		
Dimensions (width x depth x height)								
1-pole	in.	1.00 x 2.36 x 5.12					–	
2-pole	in.	2.00 x 2.36 x 5.12					2.76 x 2.36 x 5.91	
3-pole	in.	3.00 x 2.36 x 5.12					4.13 x 2.36 x 5.91	
Weight								
1-pole	lbs.	0.54					–	
2-pole	lbs.	1.04					1.61	
3-pole	lbs.	1.54					2.43	
Trip unit — Thermal-magnetic TMF					Yes		Yes	

# Part number scheme









# Ordering codes

- 3/2      A1 ordering information**
- 3/4      A2 ordering information**
- 3/5      Configured circuit-breakers ordering information**

# A1 ordering information



A1 100 A — Fixed (F) 1-pole — Front terminals (F), thermal-magnetic trip unit — TMF Icu (240 V)

In	I <sub>3</sub>	A (10 kA)	N (18 kA)
15	400	1SDA069697R1	1SDA069709R1
20	400	1SDA069699R1	1SDA069710R1
25	400	1SDA069700R1	1SDA069711R1
30	400	1SDA069701R1	1SDA069712R1
40	400	1SDA069702R1	1SDA069713R1
50	500	1SDA069703R1	1SDA069714R1
60	600	1SDA069704R1	1SDA069715R1
70	700	1SDA069705R1	1SDA069716R1
80	800	1SDA069706R1	1SDA069717R1
90	900	1SDA069707R1	1SDA069718R1
100	1000	1SDA069708R1	1SDA069719R1



A1 100 A — Fixed (F) 2-pole — Front terminals (F), thermal-magnetic trip unit — TMF Icu (240 V)

In	I <sub>3</sub>	A (10 kA)	N (25 kA)
15	400	1SDA069720R1	1SDA069731R1
20	400	1SDA069721R1	1SDA069732R1
25	400	1SDA069722R1	1SDA069733R1
30	400	1SDA069723R1	1SDA069734R1
40	400	1SDA069724R1	1SDA069735R1
50	500	1SDA069725R1	1SDA069736R1
60	600	1SDA069726R1	1SDA069737R1
70	700	1SDA069727R1	1SDA069738R1
80	800	1SDA069728R1	1SDA069739R1
90	900	1SDA069729R1	1SDA069740R1
100	1000	1SDA069730R1	1SDA069741R1

A1 100 A — Fixed (F) 2-pole - Front terminals (F), thermal-magnetic trip unit — TMF Icu (240V) in compliance with PNS Stds. (Philippines)

In	I <sub>3</sub>	A (10 kA)	N (25 kA)
100	1000 (UL only) - 1100 (PNS only)	1SDA114832R1	1SDA114834R1



—  
**A1 100 A — Fixed (F) 3-pole — Front terminals (F), thermal-magnetic trip unit — TMF Icu (240 V)**

In	I <sub>3</sub>	A (10 kA)	N (25 kA)
15	300	1SDA069742R1	1SDA069753R1
20	300	1SDA069743R1	1SDA069754R1
25	300	1SDA069744R1	1SDA069755R1
30	300	1SDA069745R1	1SDA069756R1
40	400	1SDA069746R1	1SDA069757R1
50	500	1SDA069747R1	1SDA069758R1
60	600	1SDA069748R1	1SDA069759R1
70	700	1SDA069749R1	1SDA069760R1
80	800	1SDA069750R1	1SDA069761R1
90	900	1SDA069751R1	1SDA069762R1
100	1000	1SDA069752R1	1SDA069763R1

—  
**A1 100 A — Fixed (F) 3-pole - Front terminals (F), thermal-magnetic trip unit — TMF Icu (240V) in compliance with PNS Stds. (Philippines)**

In	I <sub>3</sub>	A (10 kA)	N (25 kA)
100	1000 (UL only) - 1100 (PNS only)	1SDA114833R1	1SDA114835R1

A2 ordering information



A2 250 A — Fixed (F) 2-pole — Front terminals (F), thermal-magnetic trip unit — TMF Icu (240 V)

In	I3	A (10 kA)	N (25 kA)
125	1250	1SDA069776R1	1SDA069783R1
150	1500	1SDA069778R1	1SDA069784R1
175	1750	1SDA069779R1	1SDA069785R1
200	2000	1SDA069780R1	1SDA069786R1
225	2250	1SDA069781R1	1SDA069787R1
250	2500	1SDA069782R1	1SDA069788R1



A2 250 A — Fixed (F) 3-pole — Front terminals (F), thermal-magnetic trip unit — TMF Icu (240 V)

In	I3	A (10 kA)	N (25 kA)
125	1250	1SDA069789R1	1SDA069795R1
150	1500	1SDA069790R1	1SDA069796R1
175	1750	1SDA069791R1	1SDA069797R1
200	2000	1SDA069792R1	1SDA069798R1
225	2250	1SDA069793R1	1SDA069799R1
250	2500	1SDA069794R1	1SDA069800R1

# Configured circuit-breakers - Ordering information

The type of lugs installed on each frame is specified in the following table.

Frame	Description
A1	KIT FC CuAl 4 – 1AWG 2pcs UL
A2 2p	KIT FC CuAl A2 250Kcmil Cu - 300kcmil Al 2pcs UL
A2 3p	KIT FC CuAl A2 250Kcmil Cu - 300kcmil Al 3pcs UL

Some specific configurations of circuit-breakers with factory installed lugs are available.

The complete list of ordering codes is given in the following table.

Frame	Icu	Poles	In	Top lugs	Top LTC	Bottom lugs	Bottom LTC	Ordering Code	Description
A1	A	2	100	●		●		1SDA115154R1	A1A 100 TMF 100-1000 2p UL 2 Lug T-B
A1	A	2	100	●	●			1SDA116187R1	A1A 100 TMF 100-1000 3p UL 3 Lug TOP
A2	A	2	125			●		1SDA114298R1	A2A 250 TMF 125-1250 2p UL + 2 Lug Bot
A2	A	2	125	●	●	●		1SDA115142R1	A2A 250 TMF 125-1250 2p UL + 2 Lug T-B
A2	A	2	150			●		1SDA114299R1	A2A 250 TMF 150-1500 2p UL + 2 Lug Bot
A2	A	2	150	●	●	●		1SDA115143R1	A2A 250 TMF 150-1500 2p UL + 2 Lug T-B
A2	A	2	175			●		1SDA114300R1	A2A 250 TMF 175-1750 2p UL + 2 Lug Bot
A2	A	2	175	●	●	●		1SDA115144R1	A2A 250 TMF 175-1750 2p UL + 2 Lug T-B
A2	A	2	200			●		1SDA114301R1	A2A 250 TMF 200-2000 2p UL + 2 Lug Bot
A2	A	2	200	●	●	●		1SDA115145R1	A2A 250 TMF 200-2000 2p UL + 2 Lug T-B
A2	A	2	200	●	●			1SDA115147R1	A2A 250 TMF 200-2000 2p UL + 2 Lug Top
A2	A	2	225			●		1SDA114302R1	A2A 250 TMF 225-2250 2p UL + 2 Lug Bot
A2	A	2	225	●	●	●		1SDA115146R1	A2A 250 TMF 225-2250 2p UL + 2 Lug T-B
A2	A	3	125			●	●	1SDA114308R1	A2A 250 TMF 125-1250 3p UL + 3 Lug Bot
A2	A	3	150			●	●	1SDA114309R1	A2A 250 TMF 150-1500 3p UL + 3 Lug Bot
A2	A	3	175			●	●	1SDA114310R1	A2A 250 TMF 175-1750 3p UL + 3 Lug Bot
A2	A	3	175	●	●			1SDA115126R1	A2A 250 TMF 175-1750 3p UL + 3 Lug Top
A2	A	3	200			●	●	1SDA114311R1	A2A 250 TMF 200-2000 3p UL + 3 Lug Bot
A2	A	3	225			●	●	1SDA114312R1	A2A 250 TMF 225-2250 3p UL + 3 Lug Bot
A2	A	3	125	●	●		●	1SDA116179R1	A2A 250 TMF 125-1250 3p UL + 3 Lug TOP
A2	A	3	150	●	●		●	1SDA116180R1	A2A 250 TMF 150-1500 3p UL + 3 Lug TOP
A2	A	3	200	●	●		●	1SDA116181R1	A2A 250 TMF 200-2000 3p UL + 3 Lug TOP
A2	A	3	225	●	●		●	1SDA116182R1	A2A 250 TMF 225-2250 3p UL + 3 Lug TOP
A2	N	2	125			●		1SDA114303R1	A2N 250 TMF 125-1250 2p UL + 2 Lug Bot
A2	N	2	150			●		1SDA114304R1	A2N 250 TMF 150-1500 2p UL + 2 Lug Bot
A2	N	2	150	●	●	●		1SDA115150R1	A2N 250 TMF 150-1500 2p UL + 2 Lug T-B
A2	N	2	150	●	●			1SDA115148R1	A2N 250 TMF 150-1500 2p UL + 2 Lug Top
A2	N	2	175			●		1SDA114305R1	A2N 250 TMF 175-1750 2p UL + 2 Lug Bot
A2	N	2	175	●	●	●		1SDA115151R1	A2N 250 TMF 175-1750 2p UL + 2 Lug T-B
A2	N	2	200			●		1SDA114306R1	A2N 250 TMF 200-2000 2p UL + 2 Lug Bot
A2	N	2	200	●	●			1SDA115149R1	A2N 250 TMF 200-2000 2p UL + 2 Lug Top
A2	N	2	200	●	●	●		1SDA115152R1	A2N 250 TMF 200-2000 2p UL + 2 Lug T-B
A2	N	2	225			●		1SDA114307R1	A2N 250 TMF 225-2250 2p UL + 2 Lug Bot
A2	N	2	225	●	●	●		1SDA115153R1	A2N 250 TMF 225-2250 2p UL + 2 Lug T-B
A2	N	3	125			●	●	1SDA114313R1	A2N 250 TMF 125-1250 3p UL + 3 Lug Bot
A2	N	3	150			●	●	1SDA114314R1	A2N 250 TMF 150-1500 3p UL + 3 Lug Bot
A2	N	3	175			●	●	1SDA114315R1	A2N 250 TMF 175-1750 3p UL + 3 Lug Bot
A2	N	3	175	●	●			1SDA115127R1	A2N 250 TMF 175-1750 3p UL + 3 Lug Top
A2	N	3	200			●	●	1SDA114316R1	A2N 250 TMF 200-2000 3p UL + 3 Lug Bot
A2	N	3	225			●	●	1SDA114317R1	A2N 250 TMF 225-2250 3p UL + 3 Lug Bot
A2	N	3	125	●	●		●	1SDA116183R1	A2N 250 TMF 125-1250 3p UL + 3 Lug TOP
A2	N	3	150	●	●		●	1SDA116184R1	A2N 250 TMF 150-1500 3p UL + 3 Lug TOP
A2	N	3	200	●	●		●	1SDA116185R1	A2N 250 TMF 200-2000 3p UL + 3 Lug TOP
A2	N	3	225	●	●		●	1SDA116186R1	A2N 250 TMF 225-2250 3p UL + 3 Lug TOP





# Accessories

- 4/2** **Panorama of the accessories**
- 4/4** **Mechanical accessories and ordering codes**
- 4/4** Connection terminals
- 4/7** Terminal covers, phase separators and sealable screws
- 4/9** Key locks
- 4/11** Brackets for mounting on DIN rail
- 4/12** **Electrical accessories and ordering codes**
- 4/12** Service releases
- 4/14** Auxiliary contacts for electrical signals
- 4/14** Auxiliary contacts AUX-C Q, AUX-C SY
- 4/15** Early auxiliary contacts AUE-C (IEC only)

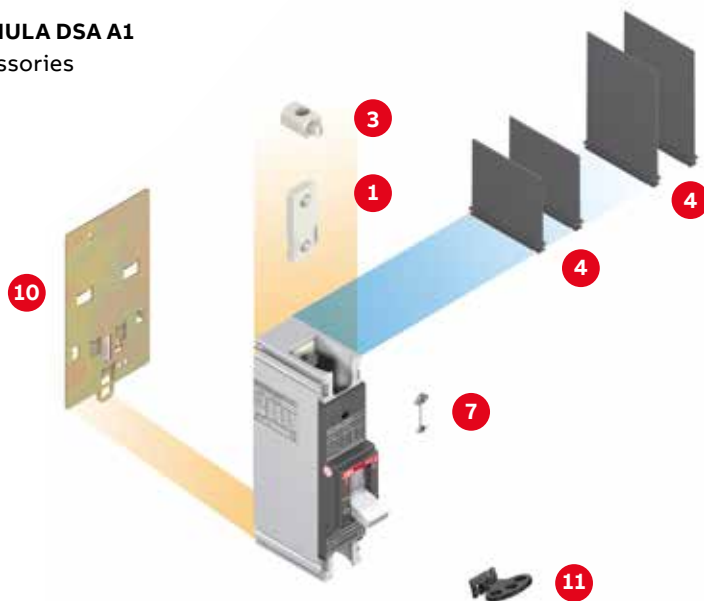
# Panorama of the accessories

## Caption

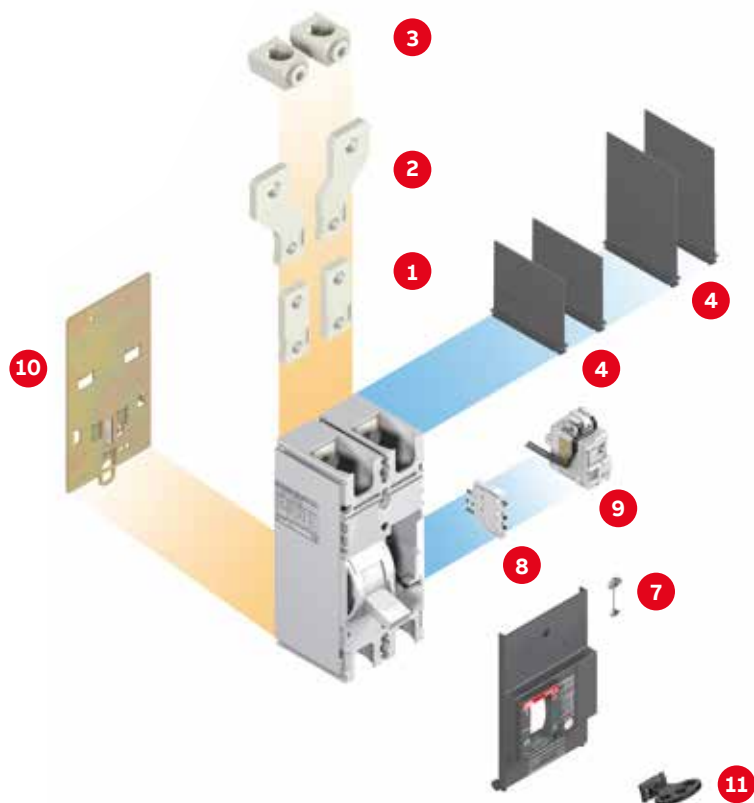
- 1** EF: extended front terminals <sup>1</sup>
- 2** ES: extended spread terminals <sup>1</sup>
- 3** FC CuAl: front terminals for copper and aluminum cables
- 4** PS: phase separators
- 5** HTC: high terminal cover
- 6** LTC: low terminal cover
- 7** Sealable screw <sup>1</sup>
- 8** AUX-C/AUE-C: auxiliary contact
- 9** SOR-C/UVR-C: service releases
- 10** DIN: DIN rail <sup>1</sup>
- 11** PLL: padlocks
- 12** RHD: rotary handle direct
- 13** RHE: extended rotary handle
- 14** Key lock <sup>1</sup>

<sup>1</sup> IEC only

## SACE FORMULA DSA A1 1-pole accessories



## SACE FORMULA DSA A1-A2 2-pole accessories



All SACE FORMULA DSA accessories are sold separately to be field installed.



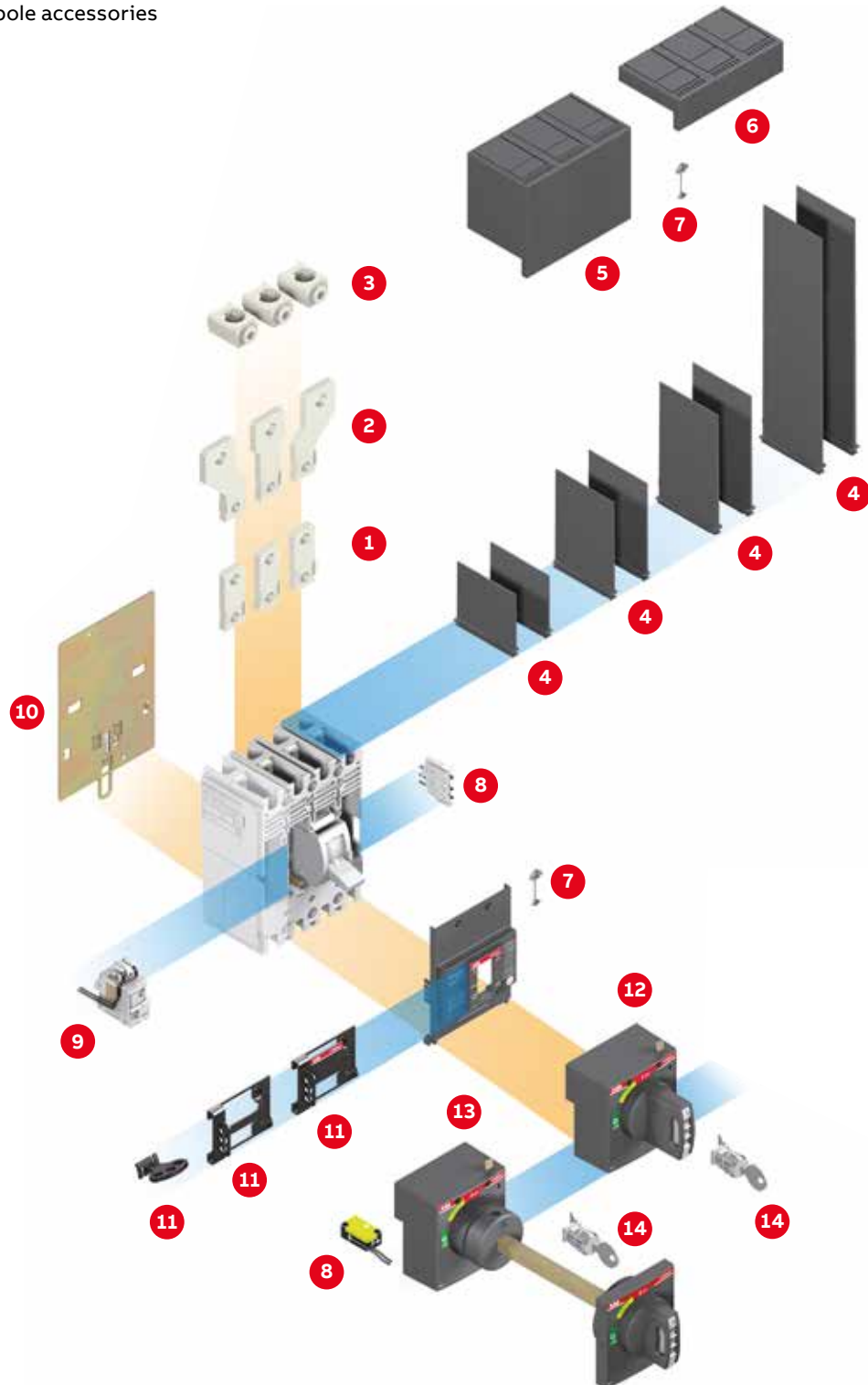
## Caption

- 1** EF: extended front terminals <sup>1</sup>
- 2** ES: extended spread terminals <sup>1</sup>
- 3** FC CuAl: front terminals for copper and aluminum cables
- 4** PS: phase separators
- 5** HTC: high terminal cover
- 6** LTC: low terminal cover
- 7** Sealable screw <sup>1</sup>
- 8** AUX-C/AUE-C: auxiliary contact
- 9** SOR-C/UVR-C: service releases
- 10** DIN: DIN rail <sup>1</sup>
- 11** PLL: padlocks
- 12** RHD: rotary handle direct
- 13** RHE: IEC = transmitted rotary handle
- 14** Key lock <sup>1</sup>

<sup>1</sup> IEC only

## SACE FORMULA DSA A1-A2

### 3-pole accessories



All SACE FORMULA DSA accessories are sold separately to be field installed.

# Mechanical accessories and ordering codes

- 01 Terminal F
- 02 Terminal F with cable lug
- 03 Terminal F with busbar
- 04 Terminal EF
- 05 Terminal EF with busbar

## Connection terminals

The connection terminals allow the circuit-breaker to be connected in the most suitable way for the desired application. Various termination options are available in both UL and IEC rated formats. The front terminals allow cables or busbars to be connected directly from the front of the circuit-breaker (cable lugs are not included).

Different types of terminals can be combined (for example, one type for the line and a different type for the load side).

The standard version of the circuit-breaker is supplied with front terminals (F). Alternative terminal options are sold separately.



01



02



03

## Front terminals - F

		Busbar dimensions (mm/in.)					Cable lug (mm/in.)		Tightening torque [Hole dimension] and [Nm]			Terminal covers				Separators			
Type	Poles	W	H	D	ø	W	ø	Terminal		Cable or busbar		2	7.5	50	60	50	80	100	200
A1	1 2 3	15/0.59	6/0.23	5/0.19	6.5/0.25	15/0.59	6.5/0.25	-	-	M6	4	-	-	R	-	S <sub>CB</sub> <sup>(2)</sup>	-	R	-
A2 <sup>(1)</sup>	2 3	25/0.98	8/0.31	6/0.23	8.5/0.33	24/0.94	8.5/0.33	-	-	M8	8	-	-	-	R	-	S <sub>CB</sub>	R	-

(1) Insulation of the switchboard door and insulating plate on the back of the circuit-breaker for use at Ue≥415 V mandatory

(2) 2P and 3P versions only



04



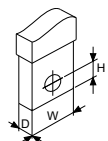
05

## Front Extended Terminals - EF

Busbar dimension MAX					Cable lug (mm/in.)		Tightening torque				Terminal covers				Separators			
Type	Poles	W	D	ø	W	ø	Terminal	Cable or busbar		2	7.5	50	60	50	80	100	200	
A1	1 2 3	15/0.59	5/0.19	8.5/0.19	15/0.59	8.5/0.33	M6	3	M8	9	-	-	R	-	S <sub>T</sub> <sup>(2)</sup>	-	R	-
A2 <sup>(1)</sup>	2 3	25/0.98	6/0.23	9/0.35	NA	NA	M8	8	M8	9	-	-	-	R	-	S <sub>CB</sub>	R	-

(1) Insulation of the switchboard door and insulating plate on the back of the circuit-breaker for use at Ue≥415 V mandatory

(2) In EF terminal kit 1pc the phase separators are not provided



- W = Width
- H = Hole height
- D = Depth
- ø = Diameter
- R = On request
- S<sub>CB</sub> = Supplied as standard with circuit-breaker, not available in the loose terminal kit
- S<sub>T</sub> = Supplied as standard with the terminal kit

- 01 Terminal ES  
—  
02 Terminal ES  
with cable lug  
—  
03 Terminal ES  
with busbar  
—  
04 Terminal FCCuAl  
—  
05 Terminal FC-  
CuAl with cable



01



02



03

#### Front extended spread terminal - ES (IEC only)

Type	Poles	Busbar dimension MAX			Cable lug (mm)		Tightening torque			Terminal covers				Separators			
		W	D	ø	W	ø	Terminal	Cable or busbar		2	7.5	50	60	50	80	100	200
A1	2 3	20/0.78	6/0.23	8.5/0.33	20/0.78	8.5	M6 3	M8 9		-	-	-	-	-	-	S <sub>T</sub>	-
A2 <sup>(1)</sup>	2 3	30/1.18	4/0.15	10.5/0.41	NA	NA	M8 8	M10 18		-	-	-	-	-	-	S <sub>T</sub>	-

(1) Insulation of the switchboard door and insulating plate on the back of the circuit-breaker for use at Ue≥415 V mandatory



04



05

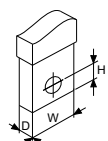
#### Front Terminals for copper aluminium cables - FCCuAl

Type Assembly	Poles	Cable [mm²]		Tightening torque [Hole dimension] and [Nm]			Length of Cable stripping [mm]	Terminal covers				Separators			
		Rigid	Terminal	Cable or busbar				2	7.5	50	60	50	80	100	200
A1	Internal	1 2 3	14-2 AWG	M6 35 lb-in	14 - 10 AWG	20 lb-in	16/0.62	-	S <sub>T</sub> <sup>(2)</sup>	R	-	S <sub>CB</sub>	-	-	-
					8 AWG	35 lb-in									
					2 AWG	75 lb-in									
A1	Internal	1 2 3	4 - 1 AWG	M6 35 lb-in		75 lb-in	16/0.62	-	S <sub>T</sub> <sup>(2)</sup>	R	-	S <sub>CB</sub>	-	-	-
A2 <sup>(1)</sup>	Internal	2 3	1 AWG - 250 kcmil Cu 2/0 AWG - 300 kcmil Al	M8 71 lb-in	1 - 4/0 AWG Cu 250 kcmil Cu 2/0 AWG - 300 kcmil Al	135 lb-in 177 lb-in 135 lb-in	20/0.78	-	S <sub>T</sub> <sup>(2)</sup>	-	R	-	S <sub>CB</sub> <sup>(3)</sup>	-	-
A2 <sup>(1)</sup>	Internal	2 3	1 AWG - 250 kcmil Cu 2/0 AWG - 300 kcmil Al	M10 71 lb-in	1 - 4/0 AWG Cu 250 kcmil Cu 2/0 AWG - 300 kcmil Al	135 lb-in 177 lb-in 135 lb-in	20/0.78	-	S <sub>T</sub> <sup>(2)</sup>	-	R	-	S <sub>CB</sub> <sup>(3)</sup>	-	-
A2 <sup>(1)</sup>	Internal	2 3	1 AWG - 250 kcmil Cu 2/0 AWG - 300 kcmil Al	M8 71 lb-in	1 - 4/0 AWG Cu 250 kcmil Cu 2/0 AWG - 300 kcmil Al	135 lb-in 177 lb-in 135 lb-in	20/0.78	-	S <sub>T</sub> <sup>(2)</sup>	-	R	-	S <sub>CB</sub> <sup>(3)</sup>	-	-
A2 <sup>(1)</sup>	Internal	2 3	350 kcmil Al	M8 71 lb-in		177 lb-in	22/0.86	-	S <sub>T</sub> <sup>(2)</sup>	-	R	-	S <sub>CB</sub> <sup>(3)</sup>	-	-

(1) insulation of the switchboard door and insulating plate on the back of the circuit-breaker for use at Ue≥415 V mandatory

(2) In FCCuAl terminal kit 2pcs the terminal covers are not provided (with exception for KIT FC CuAl A2 300kcmil Cu 300kcmil Al)

(3) Only for 2P version



- W = Width  
H = Hole height  
D = Depth  
ø = Diameter  
R = On request  
S<sub>CB</sub> = Supplied as standard with circuit-breaker, not available in the loose terminal kit  
S<sub>T</sub> = Supplied as standard with the terminal kit

# Mechanical accessories and ordering codes

## Front terminals

	1 piece	2 pieces	3 pieces	4 pieces	6 pieces
KIT F A1	1SDA066200R1	1SDA066201R1	1SDA066202R1	1SDA066203R1	1SDA066204R1
KIT F A2	–	1SDA066207R1	1SDA066208R1	1SDA066209R1	1SDA066210R1

## Front extended terminals (IEC only)

	1 piece	2 pieces	3 pieces	4 pieces	6 pieces
KIT EF A1	1SDA066212R1	1SDA066213R1	1SDA066214R1	1SDA066215R1	1SDA066216R1
KIT EF A2	–	1SDA066219R1	1SDA066220R1	1SDA066221R1	1SDA066222R1

## Front extended spread terminals (IEC only)

	1 piece	2 pieces	3 pieces	4 pieces	6 pieces
KIT ES A1	–	1SDA066224R1	1SDA066225R1	1SDA066226R1	1SDA066227R1
KIT ES A2	–	1SDA066229R1	1SDA066230R1	1SDA066231R1	1SDA066232R1

## Front terminals for copper aluminum cables — FC CuAl

	1 piece	2 pieces	3 pieces	4 pieces	6 pieces
KIT FC CuAl A1 14 - 2AWG CuAl	1SDA069971R1	1SDA069972R1	1SDA069973R1	1SDA069974R1	1SDA069975R1
KIT FC CuAl A1 4 - 1AWG CuAl	1SDA069976R1	1SDA069977R1	1SDA069978R1	1SDA069979R1	1SDA069980R1
KIT FC CuAl A2 250kcmil Cu - 300kcmil Al	1SDA069981R1	1SDA069982R1	1SDA069983R1	1SDA069984R1	1SDA069985R1
KIT FC CuAl A2 350kcmil Al	1SDA069986R1	1SDA069987R1	1SDA069988R1	1SDA069989R1	1SDA069990R1
KIT FC CuAl A2 300kcmil Cu 300kcmil Al	–	1SDA114478R1	1SDA114479R1	–	–



High terminal cover (HTC)



Low terminal cover (LTC)



Sealable screw



Phase separators (PS)

**Terminal covers, phase separators and sealable screws**

Both high (HTC) and low (LTC) terminal covers are applied to the circuit-breaker to avoid accidental contact with live parts and, in this way, to ensure protection against direct contact. The terminal covers are pre-punched for knock-out on the front to facilitate installation of busbars and/or cables, providing correct insulation.

The phase separator partitions (PS) allow the insulation characteristics between phases to be increased near the connections. They are mounted on the front by inserting them into the corresponding slots and can be applied either prior to or when the circuit-breaker is already installed. The phase separators are incompatible with both the high and the low terminal covers.

The lead sealing kit includes screws, which, when used, prevent removal of the terminal covers and/or circuit-breaker fronts, acting as a protection against direct contact and tampering. The screws can be locked with a wire and sealed with lead.

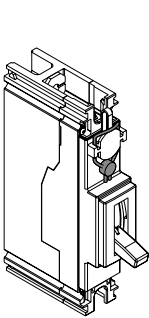
The compulsory and optional phase separators and terminal covers needed for correct installation and insulation of the circuit-breaker are indicated in the "Connection terminals" section of the accessories chapter and in the "Overall dimensions" chapter.

**Terminal covers**

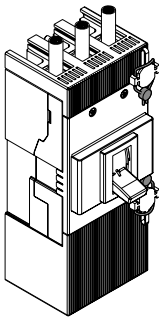
	A1	A2
HTC 3-pole, 2 pieces	1SDA066190R1	1SDA066186R1
LTC 3-pole, 2 pieces	1SDA066181R1	1SDA066183R1
Sealable screws for terminal covers	1SDA066673R1	—
Sealable screws for front	1SDA068214R1	—

**Phase separators**

	A1		A2	
	2 pieces	4 pieces	2 pieces	4 pieces
PB 50 mm	1SDA066191R1	1SDA066194R1	—	—
PB 80 mm	—	—	1SDA066192R1	1SDA066195R1
PB 100 mm	1SDA066193R1	1SDA066196R1	1SDA066193R1	1SDA066196R1
Sealable screws for front (IEC only)	1SDA068214R1	—	—	—



Sealable screw onto the circuit-breaker front



Sealable screw onto the terminal covers

# Mechanical accessories and ordering codes



Direct handle (RHD)



Extended handle (RHE)

**Rotary handle operating mechanism**  
A rotary handle operating mechanism is a control device that allows the circuit-breaker to be comfortably operated by means of a rotary handle.

- There are two types of handles:
- Direct (RHD): installed directly on the front of the circuit-breaker
  - Extended (RHE): installed through the switch-board door; RHE interacts with the circuit-breaker behind the door by means of a transmission rod.

The rotary handles, in the direct and extended version, are available for the three-pole A1 and A2 circuit-breakers both in the Standard version (grey) and in the emergency version (red on a yellow background).

- Information/settings visible and accessible to the user:
- Circuit-breaker nameplate
  - Indication of the 3 positions: open (OFF), closed (ON), tripped (TRIP)
  - Access to the test pushbutton of the rotary handle release (RHD only).

- Rotary handle operating mechanisms can be ordered:
- By using the pre-configured “kit” code (RHD and RHE)
  - By ordering the following three devices (only RHE):
    - Rotary handle on door of the compartment: Standard (RHE\_H) or emergency (RHE\_H\_EM)
    - Transmission rod of 500 mm (RHE\_S); the minimum and maximum distances between the mounting surface and the door are 62.5 mm/2.46 in. and 479.5 mm/18.88 in.
    - Base for circuit-breaker (RHE\_B).

It is possible to equip the handles with a wide range of key locks and padlocks. Each rotary handle takes up to 3 padlocks (7 mm/0.28 in. Ø stem). (See the “Key locks” paragraph in the Accessories chapter.)

The direct and extended rotary handles allow use of the early auxiliary contacts on closing in order to supply the undervoltage release in advance, before closing of the main circuit-breaker contacts (see the “Early auxiliary contacts” paragraph in the “Accessories” chapter).

**Rotary handle component**

A1-A2	
RHD A1-A2 STAND. DIRECT	1SDA066154R1
RHD_EM A1-A2 EMER. DIRECT	1SDA066156R1
RHE A1-A2 STAND. RETURNED	1SDA066158R1
RHE_EM A1-A2 EMER. RETURNED	1SDA066160R1
RHE_B A1-A2 SIDEB.R.DIST.ADJ.ROT.HAND	1SDA066162R1
RHE_S A1-A2 ROD R.D.ADJ.ROT.HAN	1SDA066164R1
RHE_H A1-A2 HANDLE R.D.ADJ.ROT.HAN	1SDA066165R1
RHE_H A1-A2 HAND.EME.R.D.ADJ.ROT.HAN	1SDA066166R1



— Fixed padlock in open position (PLL)



— Fixed padlock in open and closed position (PLL)



— Removable padlock in open position (PLL)

### Key locks

Key locks are devices (with padlocks or keys) which prevent the circuit-breaker closing or opening operation. They can be applied:

- Directly onto the front of the circuit-breaker
- Onto the direct/extended rotary handle operating mechanism
- Onto the front for lever operating mechanisms

Locking the circuit-breaker in the open position ensures isolation of the circuit according to the IEC 60947-2 Standard. Locking in closed position does not prevent release of the mechanism following a fault.

The PLL unremovable version for circuit-breaker, when it is locked in open position, does not provide access to all the dismantling screws of the device itself.

Type of key lock		Circuit-breaker	Polarity	Optional/Standard supply	CB key lock position	Type of key lock	Key withdrawability
Circuit-breaker	PLL — Fixed padlock	A1-A2	3	Optional	Open-closed	Padlocks — max. 3 padlocks Ø stem 7 mm (not supplied)	—
	PLL — Fixed padlock	A1-A2	3	Optional	Open	Padlocks — max. 3 padlocks Ø stem 7 mm (not supplied)	—
	PLL — Removable padlock	A1-A2	1 <sup>(1)</sup> , 2, 3	Optional	Open	Padlocks — max. 3 padlocks Ø stem 7 mm (not supplied)	—
	PLL — Unremovable padlock	A1	1	Optional	Open	Padlocks-max 1 padlocks Ø stem 4-5mm/0.16-0.20in (not supplied)	—
	PLL — Unremovable padlock	A1-A2	3	Optional	Open	Padlocks-max 1 padlocks Ø stem 4-5mm/0.16-0.20in (not supplied)	—
Rotary handle direct and extended	Padlock in open position	A1-A2	3	Standard	Open	Padlocks — max. 3 padlocks Ø stem 7 mm (not supplied)	—
	Compartment door key lock	A1-A2	3	Standard	Closed	Door lock <sup>(2)</sup>	—
	RHL-S key lock in open pos.	A1-A2	3	Optional	Open	Same Ronis keys	Open
	RHL-D key lock in open pos.	A1-A2	3	Optional	Open	Different Ronis keys	Open
	RHL-D key lock in open and closed position	A1-A2	3	Optional	Open-closed	Different Ronis keys	Open/closed

(1) A2 is not available in a single-pole version.

(2) Function can be completely excluded by the customer during assembly of the handle (A1 and A2).



# Mechanical accessories and ordering codes



—

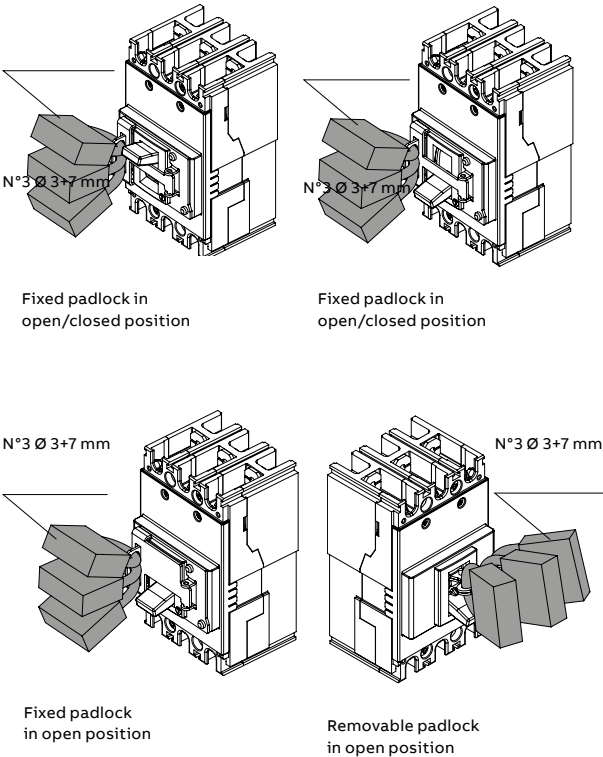
**Padlocks for lever operating mechanism of the circuit-breaker**

A1–A2	
PLL — Padlocks removable in open position	1SDA066259R1
PLL — Padlocks fixed in open position	1SDA066171R1
PLL — Padlocks fixed in open and closed position	1SDA066172R1
PLL — A1 unremovable padlock device in open position 1p	1SDA069881R1
PLL — A1-A2 unremovable padlock device in open position 3p-4p	1SDA069882R1

—

**Key lock on handle and front for lever operating mechanism (IEC only)**

A1–A2	
RHL-D Key lock in open position, different keys	1SDA066173R1
RHL-S Key lock in open position, same keys type A	1SDA066174R1
RHL-S Key lock in open position, same keys type B	1SDA066175R1
RHL-S Key lock in open position, same keys type C	1SDA066176R1
RHL-S Key lock in open position, same keys type D	1SDA066177R1
RHL-D Key lock in open/closed position, different keys	1SDA066178R1







Bracket for DIN rail

**Brackets for mounting on DIN rail**

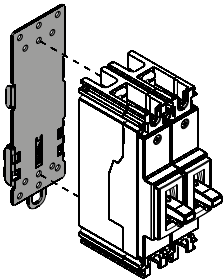
The bracket, applied on the back of the circuit-breakers, allows installation on a standardized DIN EN 50022 rail so as to simplify mounting in standard installations.

The bracket for mounting on DIN rail can be used with the following SACE FORMULA DSA circuit-breakers:

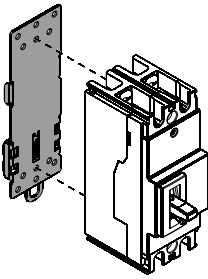
- A1 in 1p, 2p, 3p version
- A2 in 2p, 3p version

**Bracket for mounting on DIN rail (IEC only, not labeled for UL)**

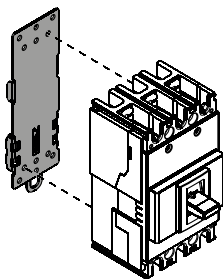
	A1-A2
Bracket for 1p, 2p, 3p	1SDA066180R1



Bracket for DIN rail  
for 1p circuit-breaker



Bracket for DIN rail  
for 2p circuit-breaker



Bracket for DIN rail  
for 3p circuit-breaker

## Electrical accessories and ordering codes



Cabled service release  
SOR-C and UVR-C

### Service releases

The cabled shunt opening release SOR-C allows for opening of the circuit-breaker by means of a non-permanent electrical control. Operation of the release is guaranteed for a voltage between 70% and 110% of the power supply rated voltage value  $U_n$ , in both alternating and direct current. It is fitted with an integrated limit contact for cutting off the power supply.

The cabled undervoltage release UVR-C ensures opening of the circuit-breaker for lack/lowering of the release power supply voltage. Opening is guaranteed when the voltage is between 70% and 35% of  $U_n$ . After tripping, the circuit-breaker can be closed again starting from a voltage higher than 85% of  $U_n$ . With the undervoltage release de-energized, it is impossible to close the circuit-breaker and/or the main contacts.

The service releases SOR-C and UVR-C for SACE FORMULA DSA can be mounted as alternatives to each other and are only available in the cabled version (20AWB cable section/0.5 mm<sup>2</sup>), with 1 m long cables. For A1 and A2, screw-less, snap-on assembly is carried out in the special internal compartment of the circuit-breaker. In the following circuit-breakers:

- Two-pole (A1, A2), the SOR-C or UVR-C can be mounted as an alternative in the right-hand slot
- Three-pole (A1, A2), the SOR-C or UVR-C can be mounted as an alternative in the left-hand slot.

### SOR-C — Electrical characteristics

		Absorbed power on inrush
		SOR-C A1-A2
Versions	AC (VA)	DC (W)
12 V DC	-	50
24–30 V AC/DC	50–65	50–65
48–60 V AC/DC	60	60
110–127 V AC — 110–125 V DC	50	50
220–240 V AC — 220–250 V DC	50–60	50–60

### UVR-C — Electrical characteristics

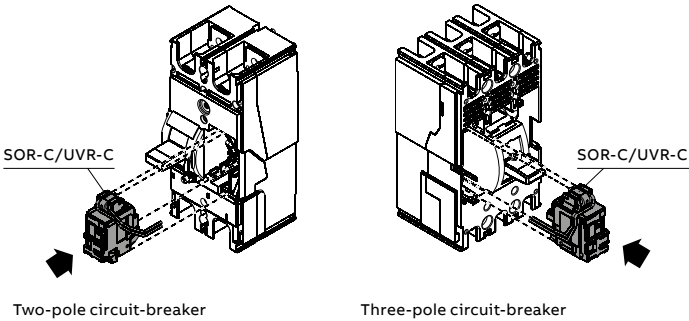
		Absorbed power during normal operation
		UVR-C A1-A2
Version	AC (VA)	DC (W)
24–30 V AC/DC	1.5	1.5
48 V AC/DC	1	1
60 V AC/DC	1	1
110–127 V AC — 110–125 V DC	2	2
220–240 V AC — 220–250 V DC	2.5	2.5

—  
**Shunt opening release — SOR-C**

	A1–A2
SOR-C 12 V DC	1SDA066133R1
SOR-C 24–30 V AC/DC	1SDA066134R1
SOR-C 48–60 V AC/DC	1SDA066135R1
SOR-C 110–127 V AC — 110–125 V DC	1SDA066136R1
SOR-C 220–240 V AC — 220–250 V DC	1SDA066137R1

—  
**Undervoltage release — UVR-C**

	A1–A2
UVR-C 24–30 V AC/DC	1SDA066143R1
UVR-C 48 V AC/DC	1SDA066144R1
UVR-C 60 V AC/DC	1SDA067114R1
UVR-C 110–127 V AC — 110–125 V DC	1SDA066145R1
UVR-C 220–240 V AC — 220–250 V DC	1SDA066146R1





# Electrical accessories and ordering codes



Cabled auxiliary contact

**Auxiliary contacts for electrical signals**  
The auxiliary contacts allow information about the state of the circuit-breaker to be available through an electronic signal to another apparatus.

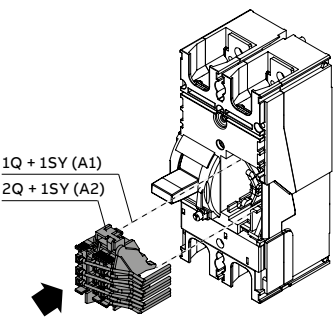
- The signals available are as follows:
- Form C (open/closed): signaling the position of the circuit-breaker power contacts (Q)
  - Bell alarm (release trip): signaling circuit-breaker opening due to tripping of the thermal-magnetic or electronic trip unit (due to overload or short circuit), of the opening of the shunt opening release or undervoltage release (SOR-C or UVR-C) or by activation of the test pushbutton (SY).

**Auxiliary contacts AUX-C Q, AUX-C SY**  
The auxiliary contacts for A1 and A2 snap into the special slot of the circuit-breaker without the use of any screws. All the auxiliary contacts are supplied in the cabled version (20 AWG cable section/0.5 mm²), with loose cables 1 m long.

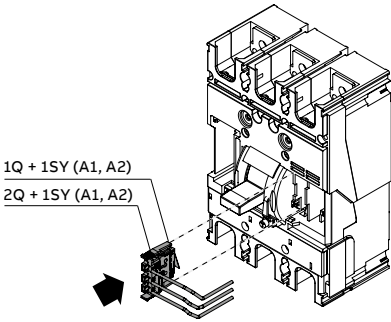
An AUX-C contact is also available as a spare part, and it can be used as Q or SY according to the slot of the circuit-breaker in which it is inserted.

AUX-C — Electrical characteristics

Power supply voltage	Operating current according to the utilization category (IEC 60947-5-1)					
(V)	AC-12	AC-13	AC-14	AC-15	DC-12	DC-14
125V AC	6 A	6 A	6 A	5 A	-	-
250V AC	6 A	6 A	6 A	4 A	-	-
110V DC	-	-	-	-	0.5 A	0.05 A
250V DC	-	-	-	-	0.3 A	0.03 A



Two-pole circuit-breaker



Three-pole circuit-breaker

—

**Auxiliary contacts — AUX-C**

	A1		A2	
	2-pole	3-pole	2-pole	3-pole
<b>Cabled version (numbered cables)</b>				
AUX-C 1Q+1SY 250 V AC/DC	1SDA066151R1	1SDA066149R1	–	1SDA066149R1
AUX-C 2Q+1SY 250 V A2 2p	–	1SDA066150R1	1SDA066152R1	1SDA066150R1
AUX-C 1Q+1SY 24 V DC	1SDA069970R1	1SDA069967R1	–	1SDA069967R1
AUX-C 2Q+1SY 24 V DC	–	1SDA069968R1	1SDA069970R1	1SDA069968R1

—

**Auxiliary contacts — AUX-C**

	A1		A2	
	2-pole	3-pole	2-pole	3-pole
<b>Cabled version (spare parts) - IEC only</b>				
AUX-C 250 V 1 CONT. A1-A2	1SDA066258R1	-	-	-



—

Early auxiliary contact

**Early auxiliary contacts AUE-C (IEC only)**

The cabled early auxiliary contacts (AUE-C) are normally open contacts, which allow the undervoltage release to be supplied in advance prior to the closing of the main contacts in compliance with IEC 60204-1 and VDE 0113 Standards.

It is possible to insert up to two early auxiliary contacts on closing inside the direct and extended rotary handle operating mechanism for three-pole circuit-breakers. The contacts, supplied in the cabled version with cables 1 m long (20 AWG cable section/0.5 mm²), must be ordered in combination with an undervoltage release.

—

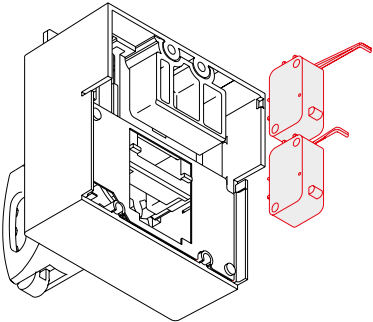
**AUE -C — Electrical characteristics**

Voltage (V)	Current (A)	
	AC	DC
125 DC	–	0.5
250 AC/DC	12	0.3

—

**Early auxiliary contacts — AUE-C (IEC only)**

A1–A2	
AUE-C	1SDA066153R1







# Installation

**5/2**      **Temperature performance**

**5/3**      **Dissipated power**

**Special applications**

**5/4**      Use of direct current apparatus

**Characteristic curves**

**5/5**      Example of curve reading

**5/6**      Trip curves with thermal-magnetic trip units

## Temperature performance

All SACE FORMULA DSA circuit-breakers can be used under the following environmental conditions:

- -25 °C to 70 °C (-13 °F to 158 °F): range of temperature where the circuit-breaker is installed
- -40 °C to 70 °C (-40 °F to 158 °F): range of temperature where the circuit-breaker is stored.

To determine tripping time using time/current curves, use  $I_t$  °C values indicated in the tables below.

**SACE FORMULA DSA A1 circuit-breaker with thermal-magnetic trip unit TMF**

In (A)	10 °C	20 °C	30 °C	40 °C	50 °C	60 °C	70 °C
5	6.5	6.1	5.8	5.4	5	4.8	4.5
10	12.9	12.2	11.5	10.8	10	9.6	9.0
15	19.4	18.4	17.3	16.2	15	14.4	13.5
20	24.6	23.5	22.4	21.2	20	19.2	18.0
25	29.2	28.2	27.2	25.9	25	24.0	22.5
30	36.8	35.3	33.6	31.8	30	28.8	27.0
40	46.7	45.2	43.5	41.5	40	38.3	36.0
50	58.3	56.5	54.3	51.9	50	47.9	45.0
60	70.0	67.8	65.2	62.2	60	57.5	54.0
70	81.7	79.1	76.1	72.6	70	67.1	63.0
80	91.0	88.5	85.6	82.1	80	76.7	72.0
90	102.4	99.6	96.3	92.4	90	86.3	81.0
100	116.7	113.0	108.7	103.7	100	95.9	90.0

**SACE FORMULA DSA A2 circuit-breaker with thermal-magnetic trip unit TMF**

In (A)	10 °C	20 °C	30 °C	40 °C	50 °C	60 °C	70 °C
125	161	153	144	135	125	114	102
150	184	176	168	159	150	138	126
160	196	188	179	169	160	148	135
175	215	206	196	185	175	160	144
200	246	235	224	212	200	183	165
225	290	276	260	243	225	205	184
250	323	306	289	270	250	228	204

Note: Temperature ratings and performances above are per IEC Standard test results.



## Dissipated power

For each circuit-breaker, the table below gives the dissipated power values for a single-pole circuit-breaker. The maximum total dissipated power

of a two-pole or three-pole circuit-breaker used at 50/60 Hz is equal to the dissipated power for the single-pole multiplied by the number of poles.

### Power (with pole) TMF

In (A)	A1	A2
15	2.5	–
20	3	–
25	3	–
30	4	–
40	4.5	–
50	5.5	–
60	6	–
70	8	–
80	9	–
90	7	–
100	8	–
125	–	7
150	–	8
175	–	10
200	–	12
225	–	14
250	–	16

Note: Dissipated power values above are per IEC Standard test results.

Power losses give indication of the heat generated under specified conditions. Measurement of power losses is performed on new samples in free air (according to Annex G of IEC 60947-2). The measurement of resistance cannot be directly related to the power loss of the device and it is not the proper parameter to assess poor performance of the poles.

# Special applications

## Use of direct current apparatus

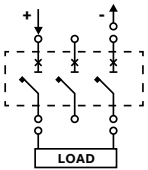
**Variation in magnetic tripping**

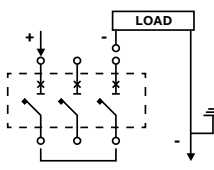
The thermal-magnetic trip units of the SACE FORMULA DSA circuit-breakers are suitable for use in direct current applications.

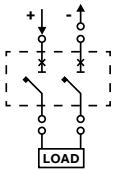
For the protection thresholds against short-circuits, correction values (Km) must be applied

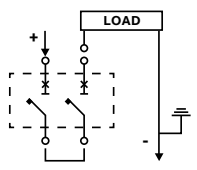
based on the distribution network type and the number of poles to be connected in series (the thermal threshold does not undergo any alteration).

The correction value to be used can be found in the following tables.

Insulated network	
Un	≤ 250
<div>Protection + Insulation function</div> 	
A1	2
A2	1.4

Network with one grounded polarity	
Un	≤ 250
<div>Protection function</div> 	
A1	2
A2	1.4

Insulated network	
Un	≤ 250
<div>Protection + Insulation function</div> 	
A1	2
A2	1.4

Network with one grounded polarity	
Un	≤ 250
<div>Protection function</div> 	
A1	2
A2	1.4

# Characteristic curves

## Example of curve reading

### Example A1 100 TMF $I_n=70A$

#### Trip curves for distribution (thermal-magnetic trip unit)

These curves provide information about the tripping time of the thermal-magnetic trip units. The red band indicates the hot trip times, i.e. with the circuit-breaker already loaded with its rated current once the overload has occurred.

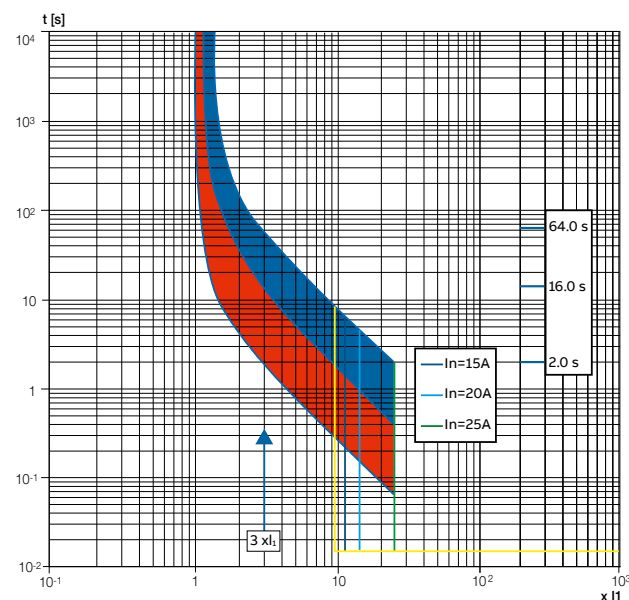
The blue band gives the cold trip times, i.e. with no current flowing into the breaker before the fault.

The curves are assumed at a reference air ambient temperature of 50°C and considering three-phase overload with symmetrical and equilibrated currents.

Let's consider a circuit-breaker A1 100 TMF  $I_n = 70A$ . Thermal protection tripping varies considerably, based on the thermal regime of the circuit-breaker. For example, for an overload current  $3xI_n$ , the trip time is between 16.0s and 64.0s for cold tripping, and between 2.0s and 16.0s for hot tripping. For fault current values higher than 700A, the circuit breaker trips with the instantaneous magnetic protection  $I_3$ .

### A1 100 TMF $I_n=15-70A$

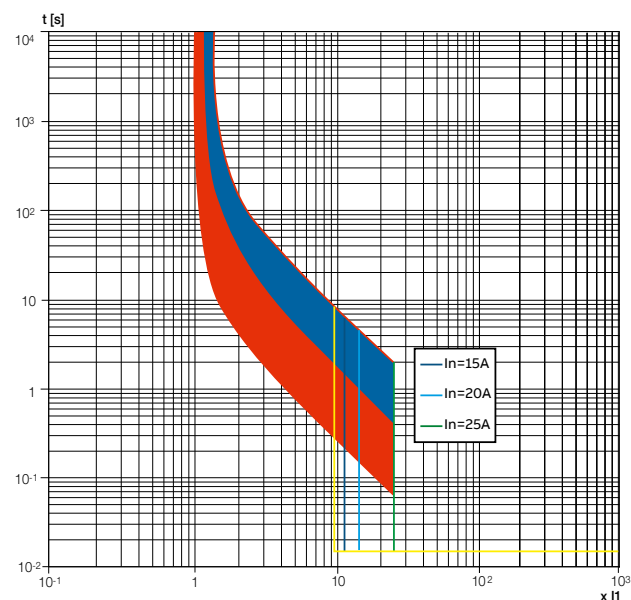
#### Trip time characteristics



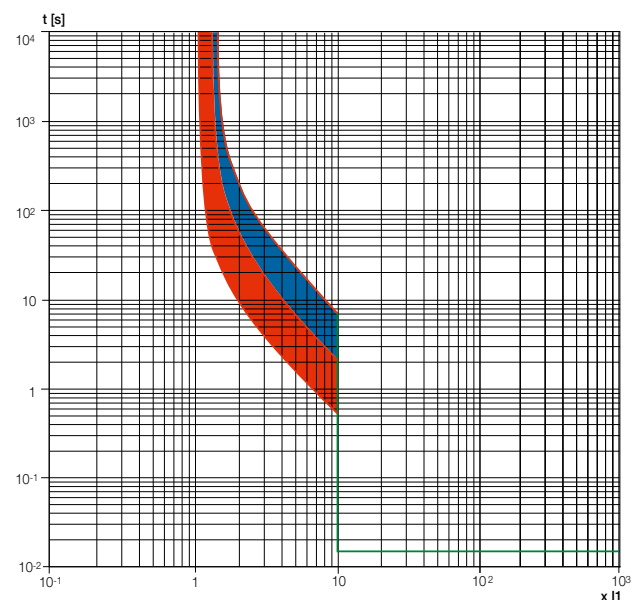
## Characteristic curves

### Trip curves with thermal-magnetic trip units

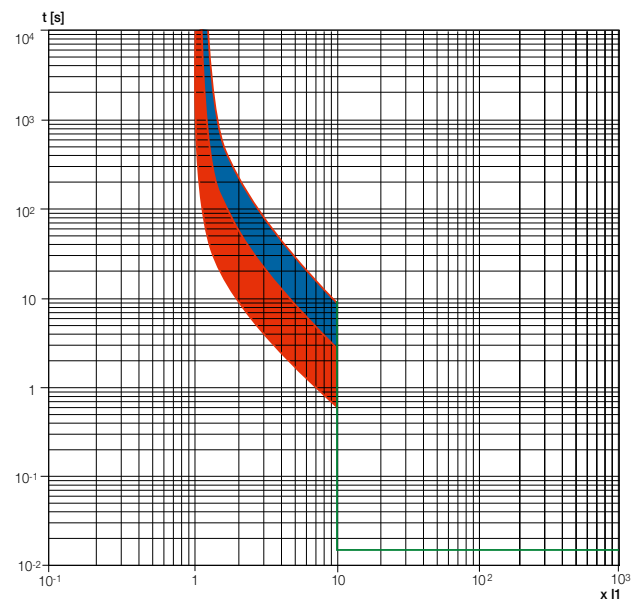
**A1 100 TMF In=15-70A**  
**Trip time characteristics**



**A1 100 TMF In=80-100A**  
**Trip time characteristics**



**A2 250 TMF In=125-250A**  
**Trip time characteristics**

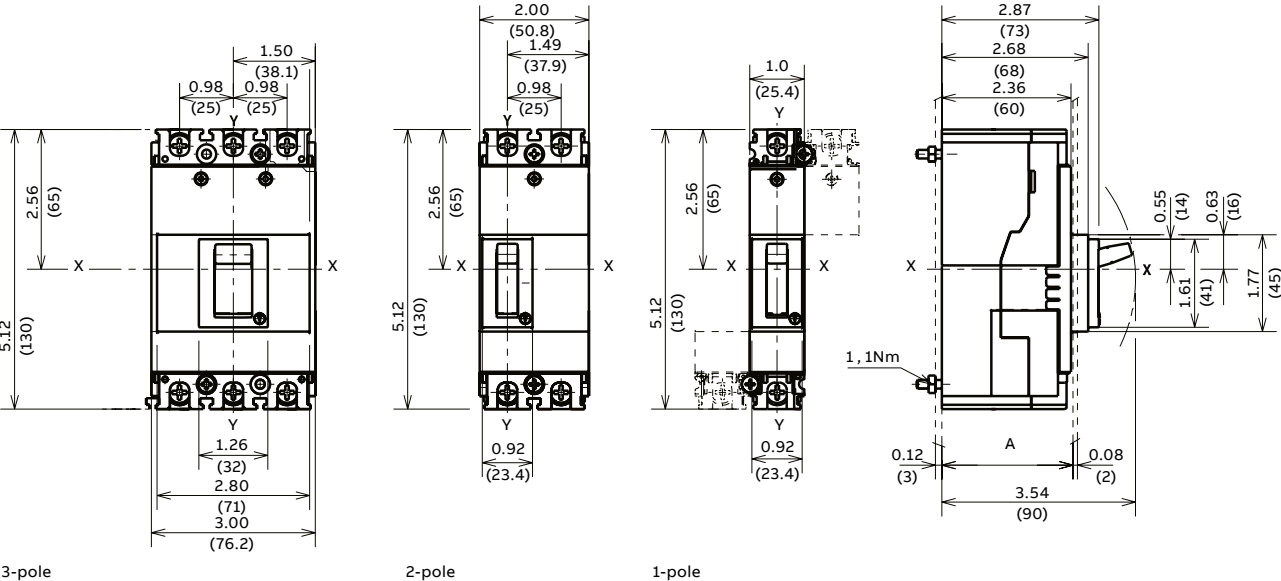


# Overall dimensions

<b>6/2</b>	<b>A1 - Circuit-breaker and terminals</b>
<b>6/2</b>	Mounting onto the back plate
<b>6/2</b>	Mounting onto DIN 50022 rail
<b>6/3</b>	Drilling templates for support sheet
<b>6/3</b>	Drilling templates for compartment door
<b>6/4</b>	F Terminals
<b>6/4</b>	EF Terminals
<b>6/5</b>	ES Terminals
<b>6/6</b>	FCCuAl 4-1 AWG Terminals
<b>6/7</b>	FC CuAl 14-2 AWG Terminals
<b>6/8</b>	Direct Rotary Handle (RHD)
<b>6/8</b>	Extended Rotary Handle (RHE)
<b>6/9</b>	<b>A2 - Circuit-breaker and terminals</b>
<b>6/9</b>	Mounting onto the back plate
<b>6/9</b>	Mounting onto DIN 50022 rail
<b>6/10</b>	Drilling templates for support sheet
<b>6/10</b>	Drilling templates for compartment door
<b>6/11</b>	F Terminals
<b>6/11</b>	EF Terminals
<b>6/12</b>	ES Terminals
<b>6/13</b>	FC CuAl 300 kcmil-350 kcmil terminals
<b>6/14</b>	FC CuAl 1 AWG-300 kcmil terminals
<b>6/15</b>	Direct Rotary Handle (RHD)
<b>6/15</b>	Extended Rotary Handle (RHE)
<b>6/16</b>	<b>Insulation distances</b>
<b>6/16</b>	Minimum insulation distances for installation in cubicles
<b>6/16</b>	Minimum center distance between two side by side circuit-breakers
<b>6/16</b>	Minimum center distance between two stacked circuit-breakers

# A1 - Circuit-breaker and terminals

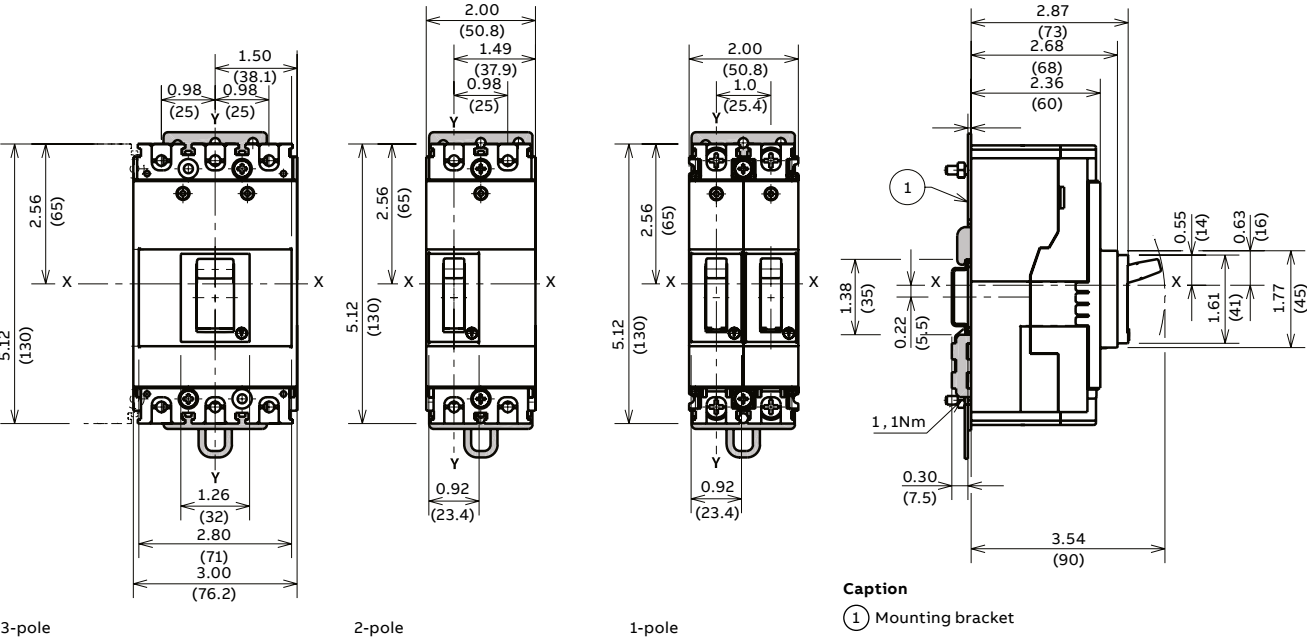
## Mounting on the back plate



Distance between compartment door and back of switchboard		A (mm/in.)
Without flange	1-, 2- and 3-pole	69/2.72
	1-, 2- and 3-pole	61/2.40

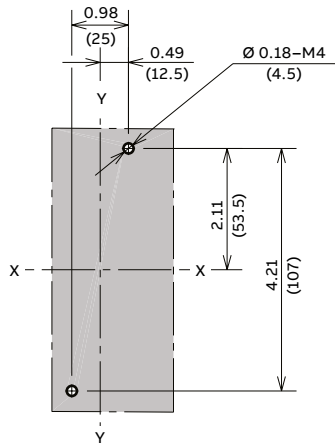
- The circuit-breaker installed at:
- A = 69 mm/2.72 in. has the front plate surrounding the lever protruding from the compartment door.
  - A = 61 mm/2.40 in. has the front plate surrounding the lever protruding from the compartment door.

## Mounting onto DIN 50022 rail

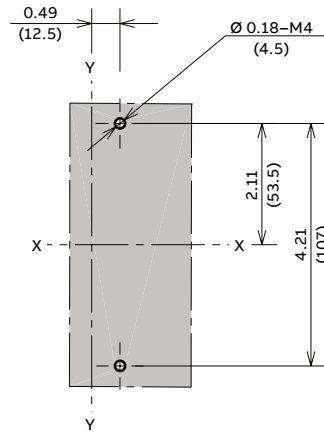


Dimensions shown are in inches (mm).

### Drilling templates for support sheet

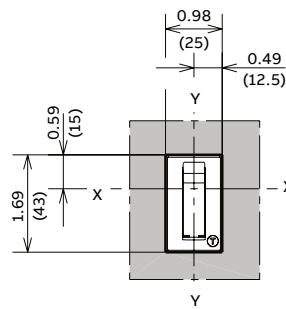
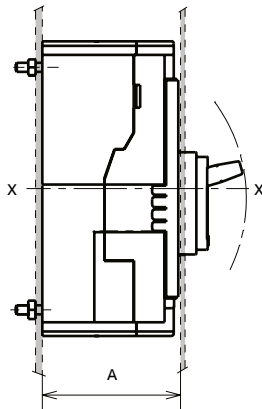
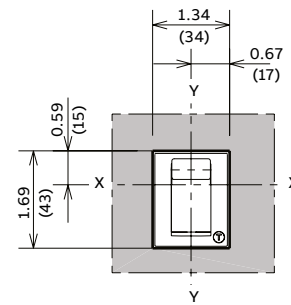
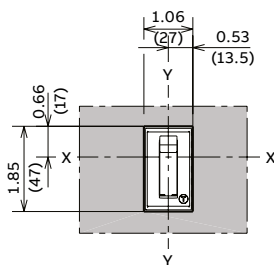
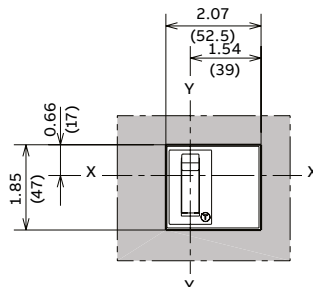
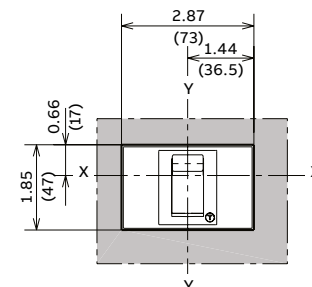


1- and 3-pole



2-pole

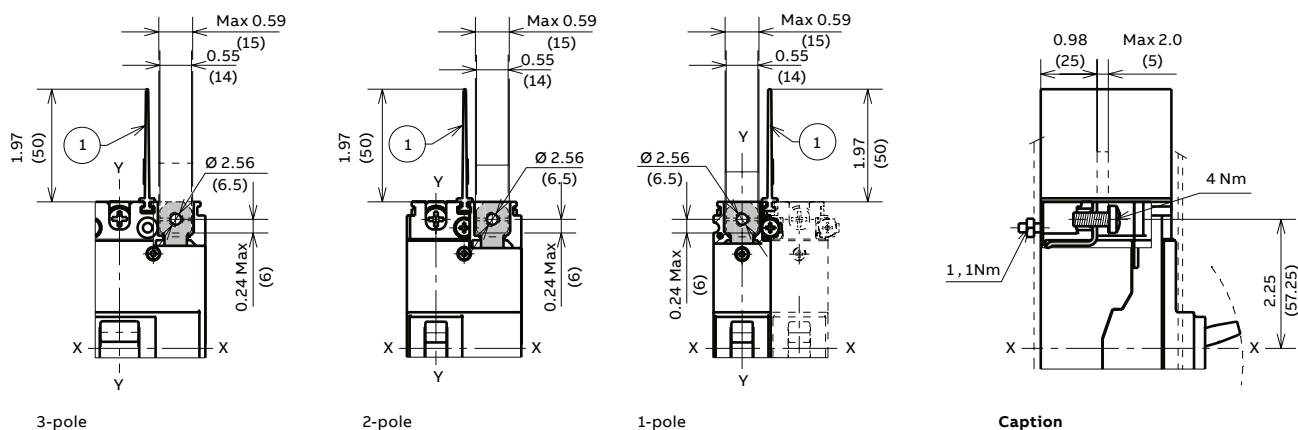
### Drilling templates for compartment door

A = 69 mm/2.72 in.  
1- and 2-poleA = 69 mm/2.72 in.  
3-poleA = 61 mm/2.40 in.  
1-poleA = 61 mm/2.40 in.  
2-poleA = 61 mm/2.40 in.  
3-pole

Dimensions shown are in inches (mm).

# A1 - Circuit-breaker and terminals

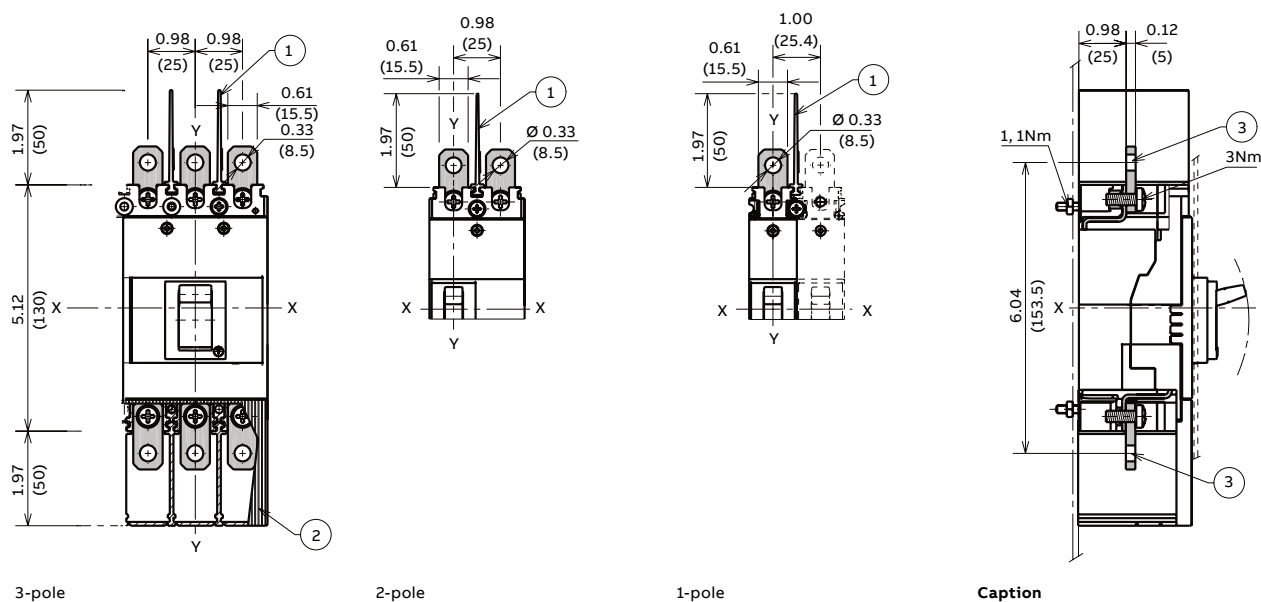
## F Terminals



### Caption

- ① 50 mm phase separators between the terminals (compulsory) supplied

## EF Terminals

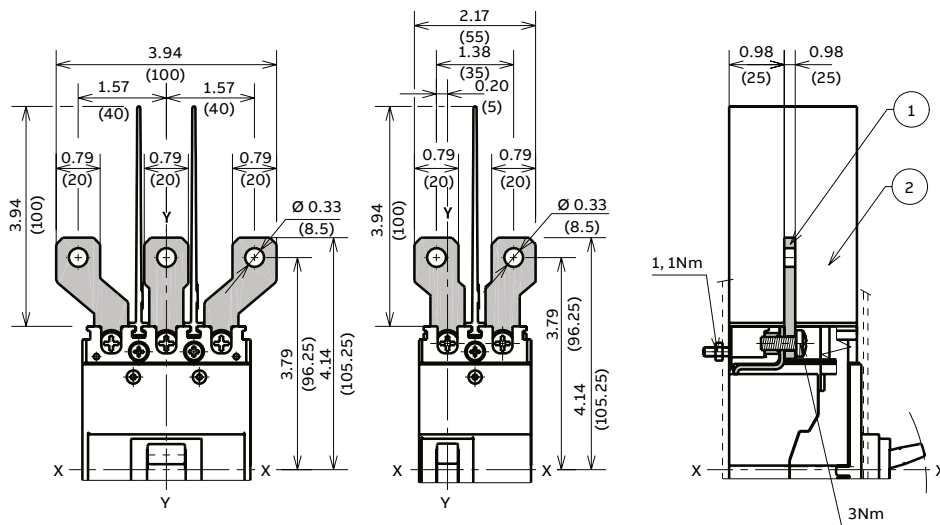


### Caption

- ① 50 mm phase separators between the terminals (compulsory) not supplied with EF terminals kit, but with the circuit-breaker in basic version  
 ② Top terminal covers with IP40 protection degree (on request)  
 ③ Front extended terminals



## ES Terminals



3-pole

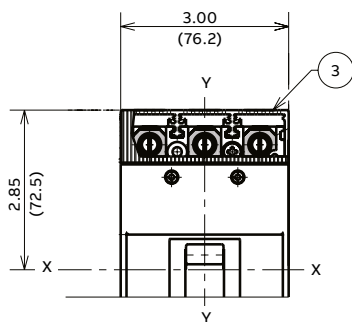
2-pole

## Caption

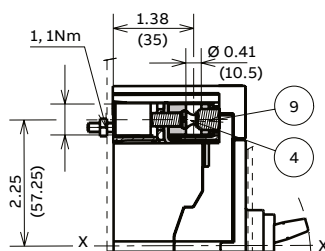
- ① Front extended spread terminals
- ② 100 mm phase separators between the terminals (compulsory) supplied

# A1 - Circuit-breaker and terminals

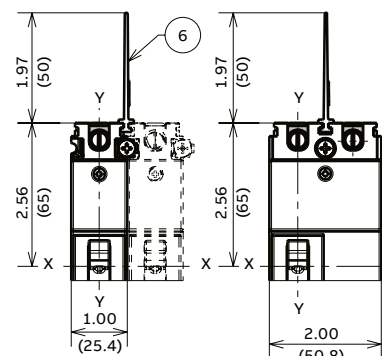
## FCCuAl 4-1 AWG Terminals



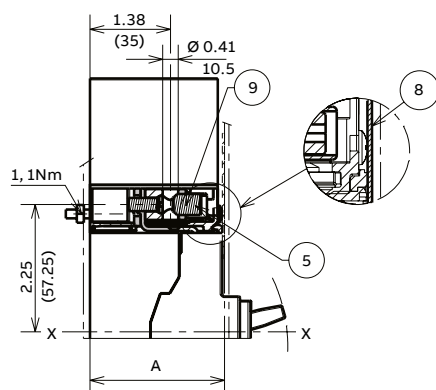
3-pole



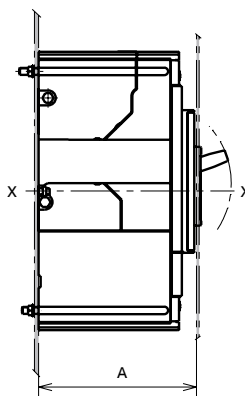
3-pole



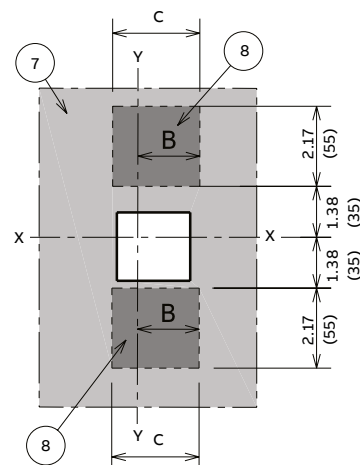
1- and 2-pole



1- and 2-pole



1- and 2-pole



1- and 2-pole

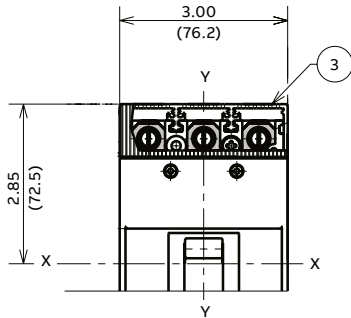
	A mm/in)	B (mm/in.)	C (mm/in.)	
Without flange	69/2.72	33/1.30	66/2.60	1-pole
	69/2.72	58/2.28	91/3.58	2-pole
	61*/2.40*	33/1.30	66/2.60	1-pole
	61*/2.40*	58/2.28	91/3.58	2-pole

\* Distance only possible with insulation plate max. 1 mm/0.04 in. thick

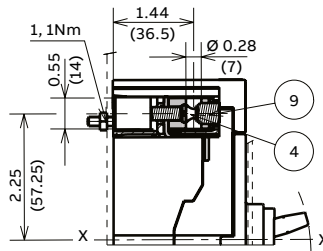
### Caption

- ③ Bottom terminal covers with IP40 protection degree (compulsory)
- ④ FC CuAl 14-2 AWG terminals
- ⑥ 50 mm phase separators between the terminals (compulsory) not supplied with FC CuAl terminals kit, but with the circuit-breaker in basic version
- ⑦ Compartment door drilling template and mounting insulation (provided by customer)
- ⑧ Compulsory internal 1-pole and 2-pole insulation plates (provided by customer)

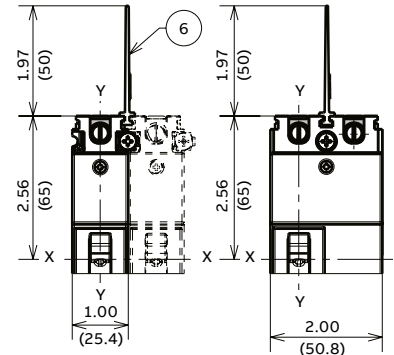
## FC CuAl 14–2 AWG Terminals



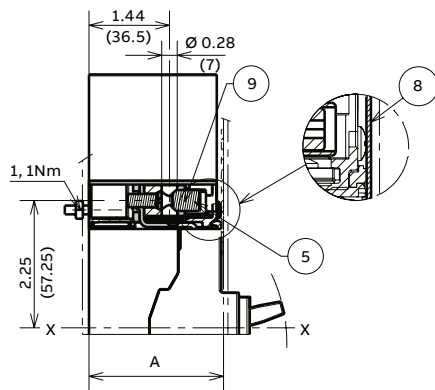
3-pole



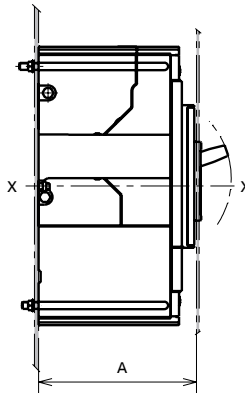
3-pole



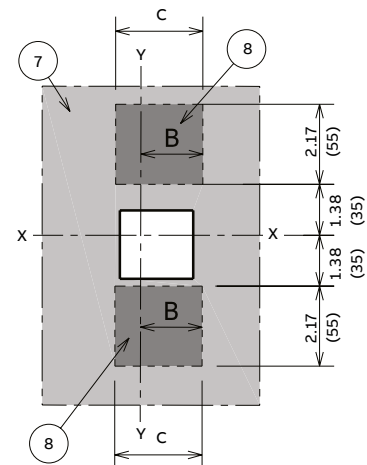
1- and 2-pole



1- and 2-pole



1- and 2-pole



1- and 2-pole

	A mm/in)	B (mm/in.)	C (mm/in.)	
Without flange	69/2.72	33/1.30	66/2.60	1-pole
	69/2.72	58/2.28	91/3.58	2-pole
	61*/2.40*	33/1.30	66/2.60	1-pole
	61*/2.40*	58/2.28	91/3.58	2-pole

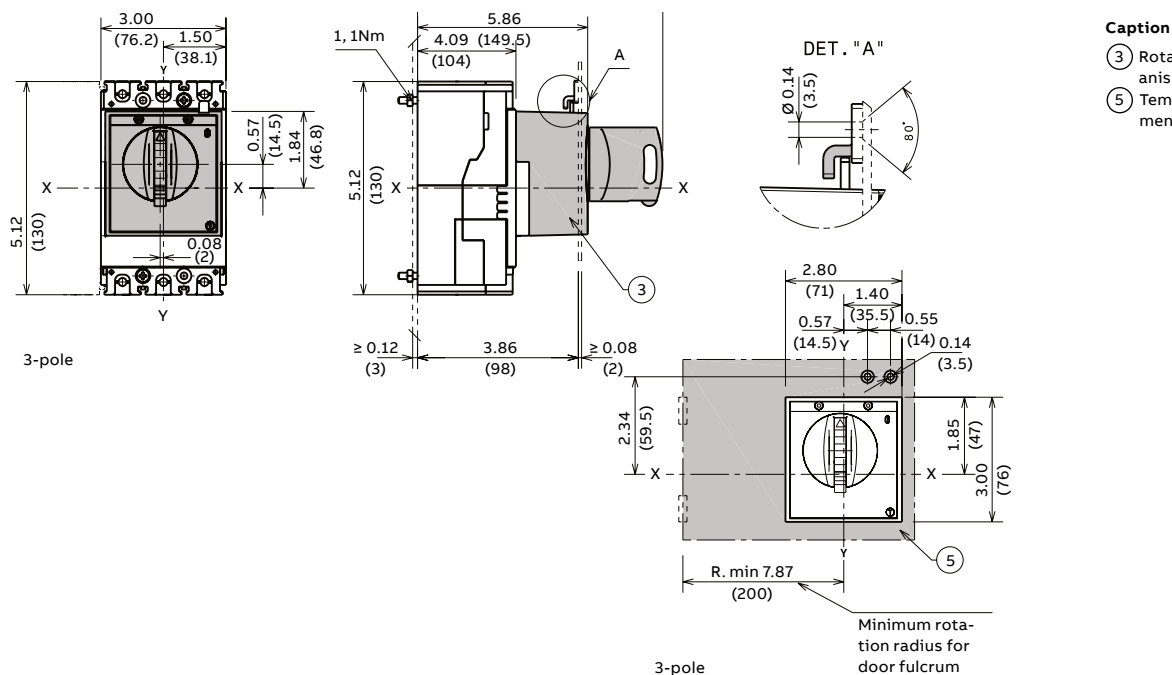
\* Distance only possible with insulation plate max. 1 mm/0.04 in. thick

## Caption

- ③ Bottom terminal covers with IP40 protection degree (compulsory)
- ④ FC CuAl 14–2 AWG terminals
- ⑥ 50 mm phase separators between the terminals (compulsory) not supplied with FC CuAl terminals kit, but with the circuit-breaker in basic version
- ⑦ Compartment door drilling template and mounting insulation (provided by customer)
- ⑧ Compulsory internal 1-pole and 2-pole insulation plates (provided by customer)

# A1 - Circuit-breaker and terminals

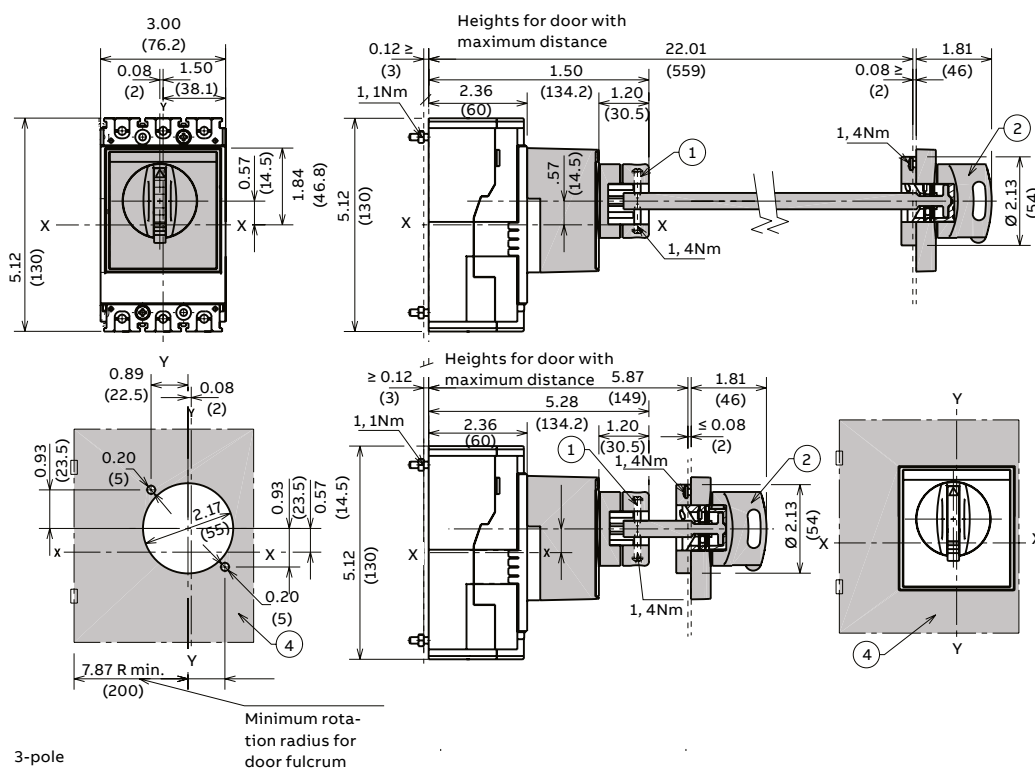
## Rotary handle operating mechanism on circuit-breaker and compartment door drilling template (RHD)



### Caption

- ③ Rotary handle operating mechanism on circuit-breaker
- ⑤ Template for drilling compartment with direct handle

## Rotary handle operating mechanism on compartment door and compartment door drilling template (RHE)

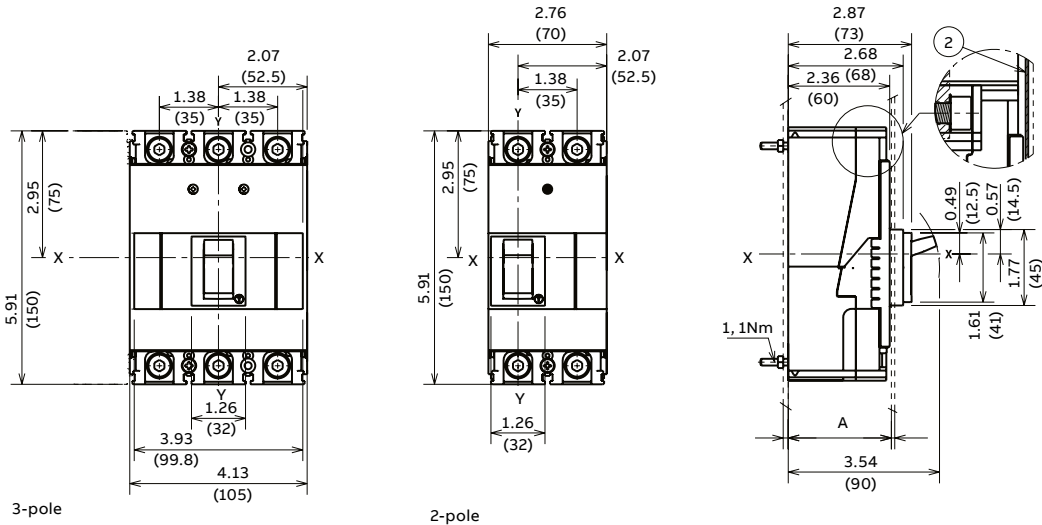


### Caption

- ① Transmission group
- ② Extended rotary handle operating mechanism
- ④ Template for drilling compartment with extended rotary handle

# A2 - Circuit-breaker and terminals

## Mounting on the back plate



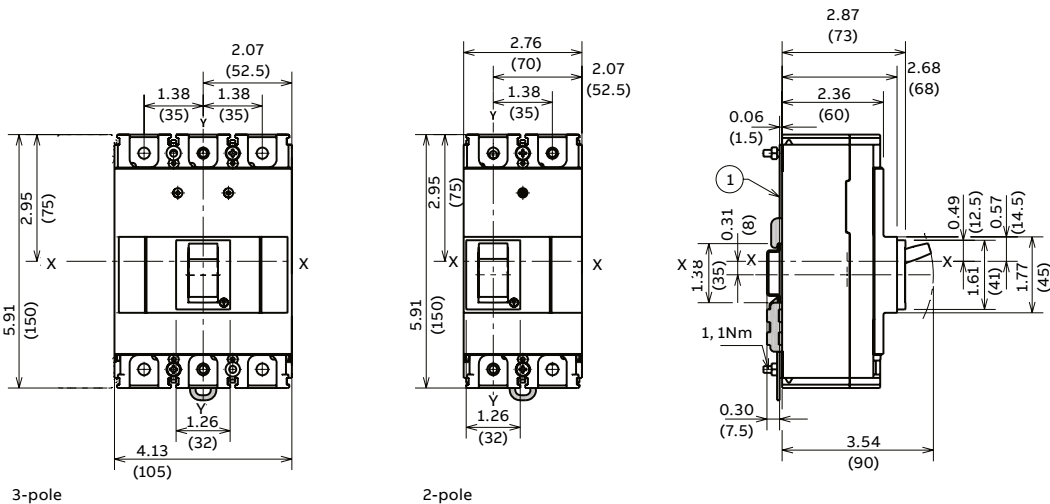
**Caption**  
② Compulsory internal insulation plates (provided by customer) for use Ue ≥415 V

Distance between compartment door and back of switchboard		A (mm/in.)
Without flange	2- and 3-pole	69/2.72
	2- and 3-pole	61/2.40

The circuit-breaker installed at:

- A = 69 mm/2.72 in. has the front plate surrounding the lever protruding from the compartment door.
- A = 61 mm/2.40 in. has the front plate surrounding the lever protruding from the compartment door.

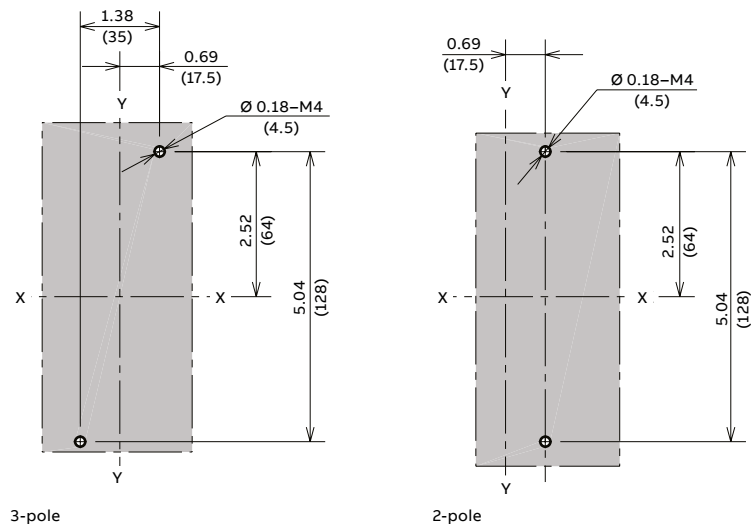
## Mounting onto DIN 50022 rail



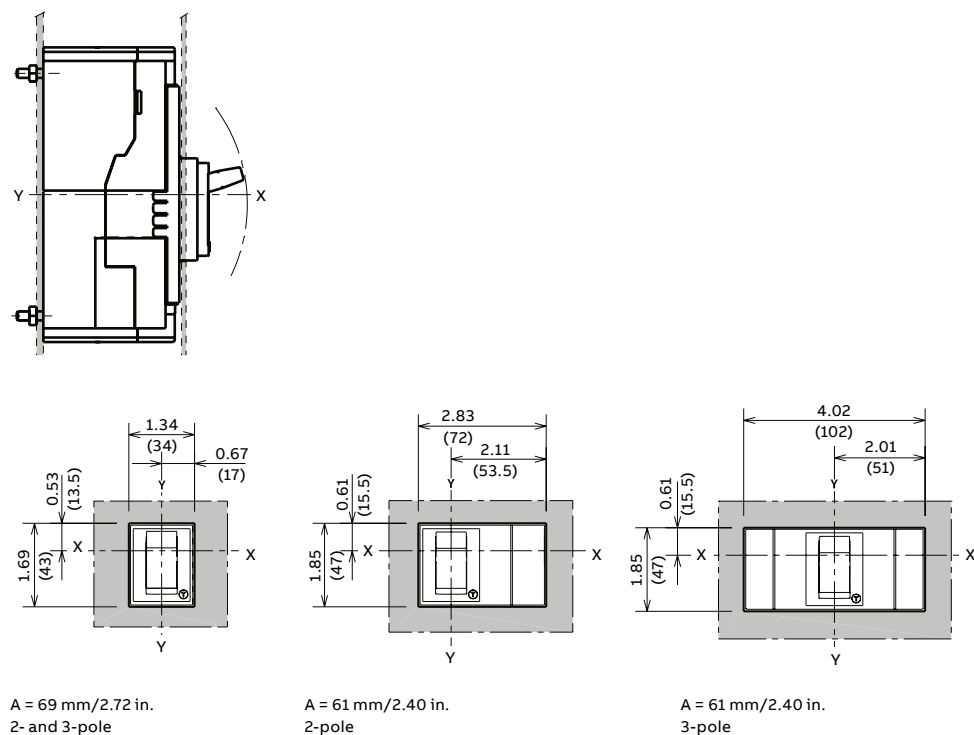
**Caption**  
① Mounting bracket

## A2 - Circuit-breaker and terminals

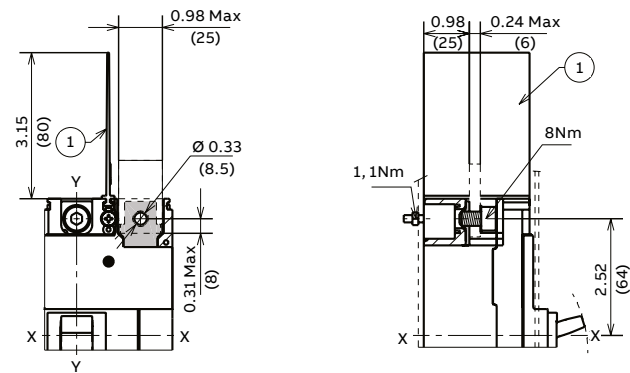
### Drilling templates for support sheet



### Drilling templates for compartment door



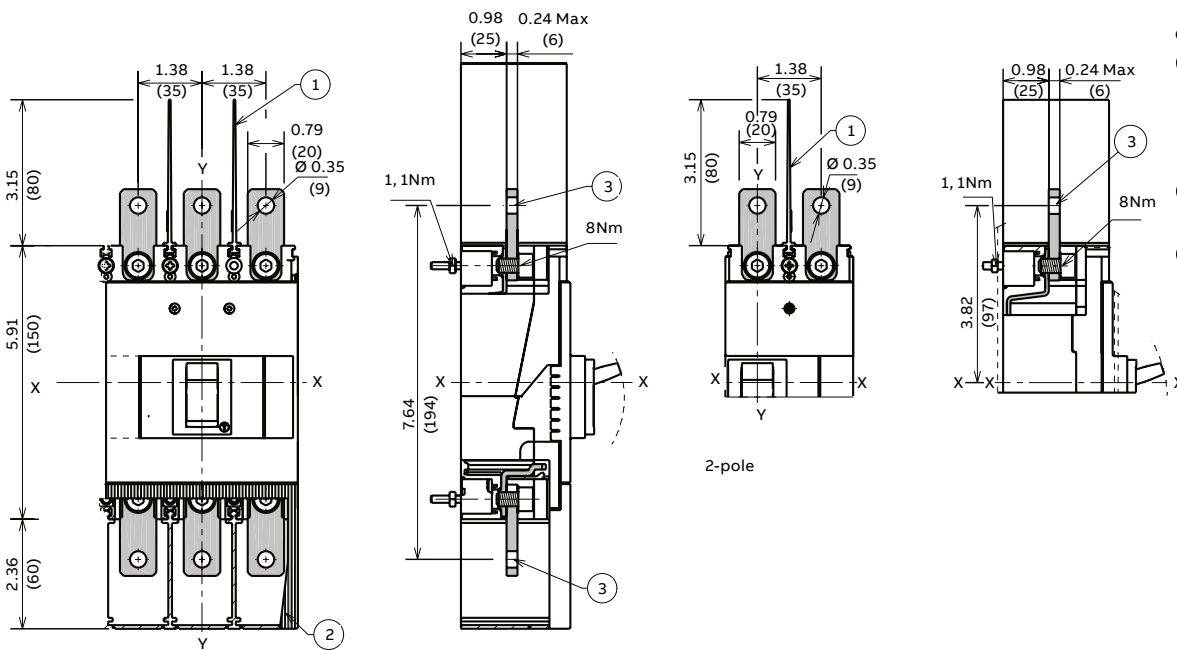
Dimensions shown are in inches (mm).

**F Terminals**

2- and 3-pole

**Caption**

- ① 80 mm phase separators between the terminals (compulsory) supplied

**EF Terminals**

3-pole

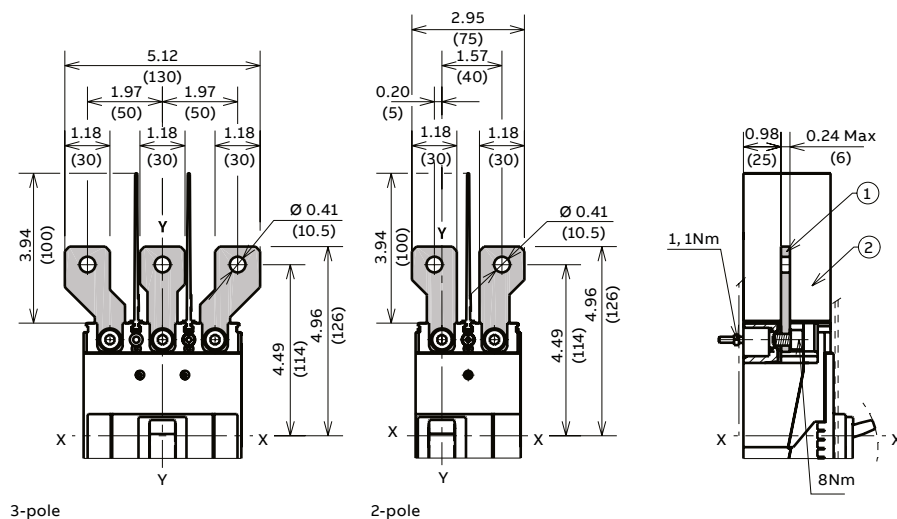
2-pole

**Caption**

- ① 80 mm phase separators between the terminals (compulsory) not supplied with EF terminals kit, but with the circuit-breaker in base version  
 ② Top terminal covers with IP40 protection degree (on request)  
 ③ Front extended terminals

## A2 - Circuit-breaker and terminals

### ES Terminals

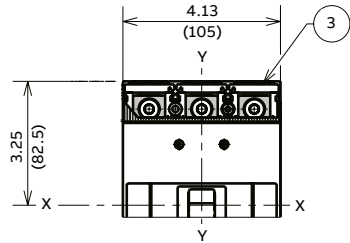


#### Caption

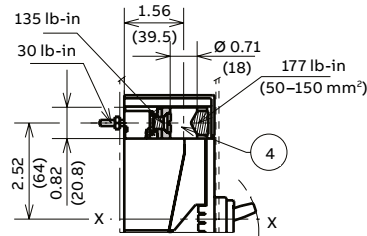
- ① Front extended spread terminals
- ② 100 mm phase separators between the terminals (compulsory) supplied



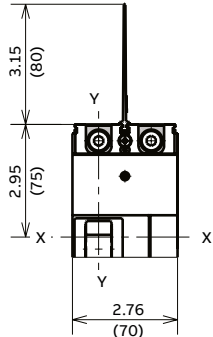
FC CuAl 300 kcmil–350 kcmil terminals



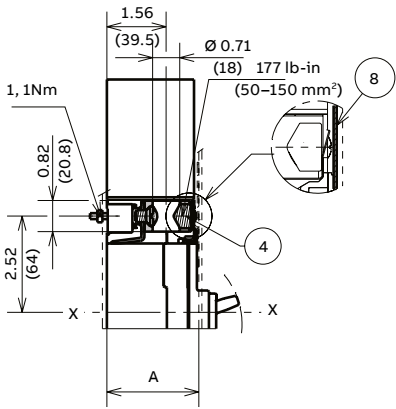
3-pole



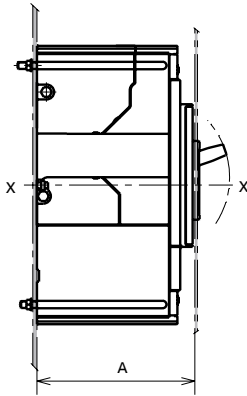
3-pole



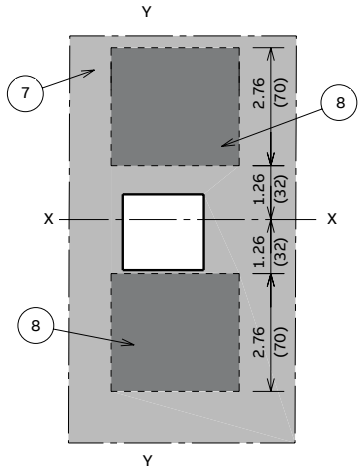
2-pole



2-pole



2-pole



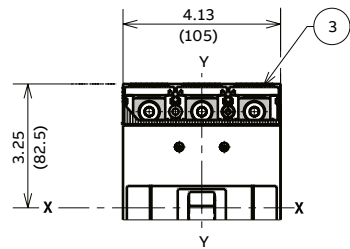
2-pole

	A (mm/in)	
Without flange	69/2.72	2-pole
	61/2.40	2-pole

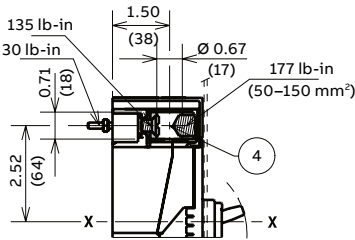
- Caption**
- ③ Terminal covers (compulsory)
  - ⑤ Terminals FC CuAl 300 kcmil–350 kcmil
  - ⑦ Compartment door drilling template and mounting insulation plate (provided by customer)
  - ⑧ Compulsory internal insulation plates (provided by customer) max. 1 mm/0.039 in. thick

# A2 - Circuit-breaker and terminals

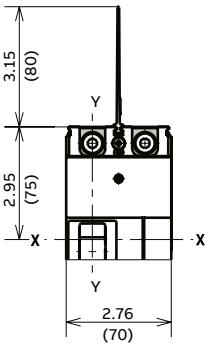
## FC CuAl 1 AWG–300 kcmil terminals



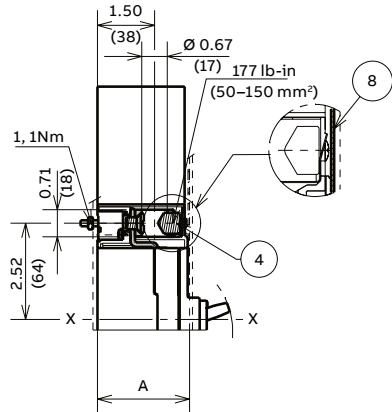
3-pole



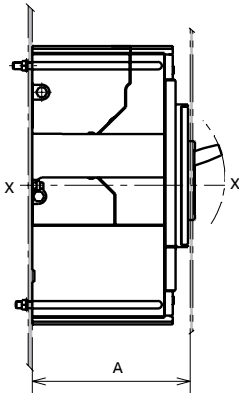
3-pole



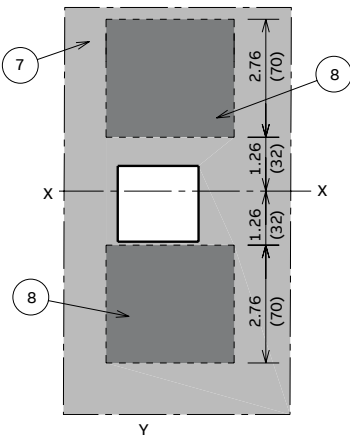
2-pole



2-pole



2-pole



2-pole

	A (mm/in.)	
Without flange	69/2.72	2-pole
	61/2.40	2-pole

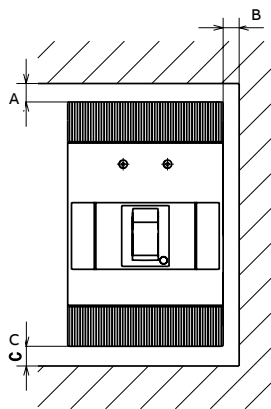
- Caption**
- ③ Terminal covers (compulsory)
  - ④ Terminals FC CuAl 1 AWG–300 kcmil
  - ⑦ Compartment door drilling template and mounting insulation plate (provided by customer)
  - ⑧ Compulsory internal insulation plates (provided by customer) max. 1 mm/0.039 in. thick

- ③ Rotary handle operating mechanism on circuit-breaker
- ⑤ Template for compartment drilling with direct handle

[illegible]

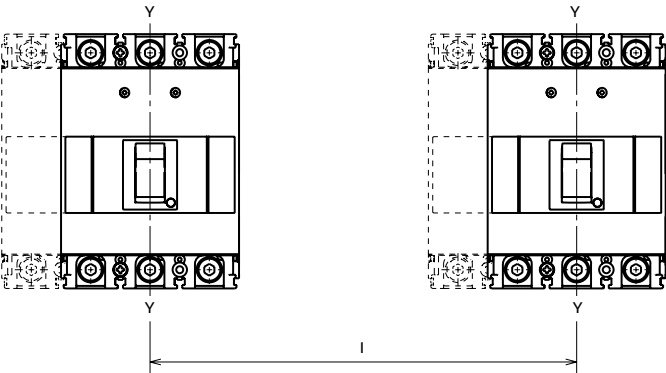
- ① Transmission group
- ② Extended rotary handle operating mechanism
- ④ Compartment drilling template with extended rotary handle

# Insulation distances



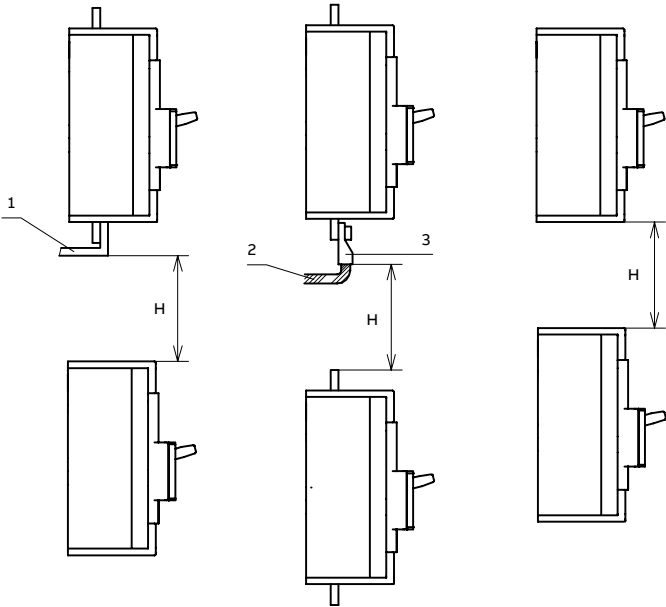
Minimum insulation distances for installation in cubicles

	A (mm/in.)	B (mm/in.)	C (mm/in.)
A1 — 1p, 2p, 3p	50/1.97	50/1.97	50/1.97
A2 — 2p, 3p	50/1.97	50/1.97	50/1.97



Minimum center distance between two side by side circuit-breakers

	Circuit-breaker width (mm/in.)			Center distance I (mm/in.)		
	1-pole	2-pole	3-pole	1-pole	2-pole	3-pole
A1	25.4/1.00	50.8/2.00	76.2/3.00	25.4/1.00	50.8/2.00	76.2/3.00
A2	—	70/2.76	105/4.13	—	70/2.76	105/4.13



Minimum center distance between two stacked circuit-breakers

	H (mm/in.)
A1	80/3.15
A2	400/15.75

- Caption**
- ① Connection not insulated
  - ② Insulated cable
  - ③ Cable terminal



# Wiring diagrams

- 7/2**      **Reading information and graphic symbols**
- 7/3**      **Wiring diagrams**
- 7/4**      **Electrical accessories**



# Reading information and graphic symbols

## State of operation represented

The diagrams are shown under the following conditions:

- Circuit-breaker open
- Circuits without voltage
- Trip unit not tripped

## Incompatibility A1 A2

Accessory circuits cannot be supplied with single-pole circuit-breakers. The applications indicated in figures 1-2-6, which are supplied as an alternative, can be supplied with two-pole circuit-breakers. All the applications indicated in the figures can be supplied with three-pole circuit-breakers. Figures 1-2-3-4 are provided as an alternative. Figures 5-6 are provided as an alternative.

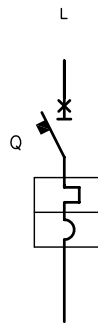
Graphic symbols (IEC 60617 and CEI 3-14 to 3-26 Standards)

	Thermal effect
	Electromagnetic effect
	Mechanical connection (link)
	Operated by pushing
	Operated by turning
	Connection of conductors
	Terminal
	Plug and socket (male and female)
	Resistor (general symbol)
	Current transformer

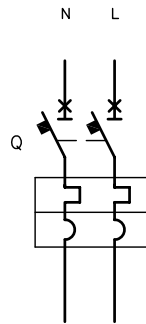
	Make contact
	Break contact
	Change-over break before make contact
	Circuit-breaker with automatic release
	Operating device (general symbol)
	Instantaneous overcurrent or rate-of-rise relay
	Overcurrent relay with inverse long time-lag characteristic

# Wiring diagrams

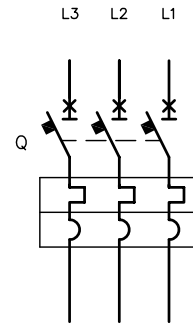
## Operating status A1 A2



Single-pole circuit-breaker<sup>1)</sup>  
with thermal-magnetic trip unit  
1) A1 only



Two-pole circuit-breaker  
with thermal-magnetic trip unit

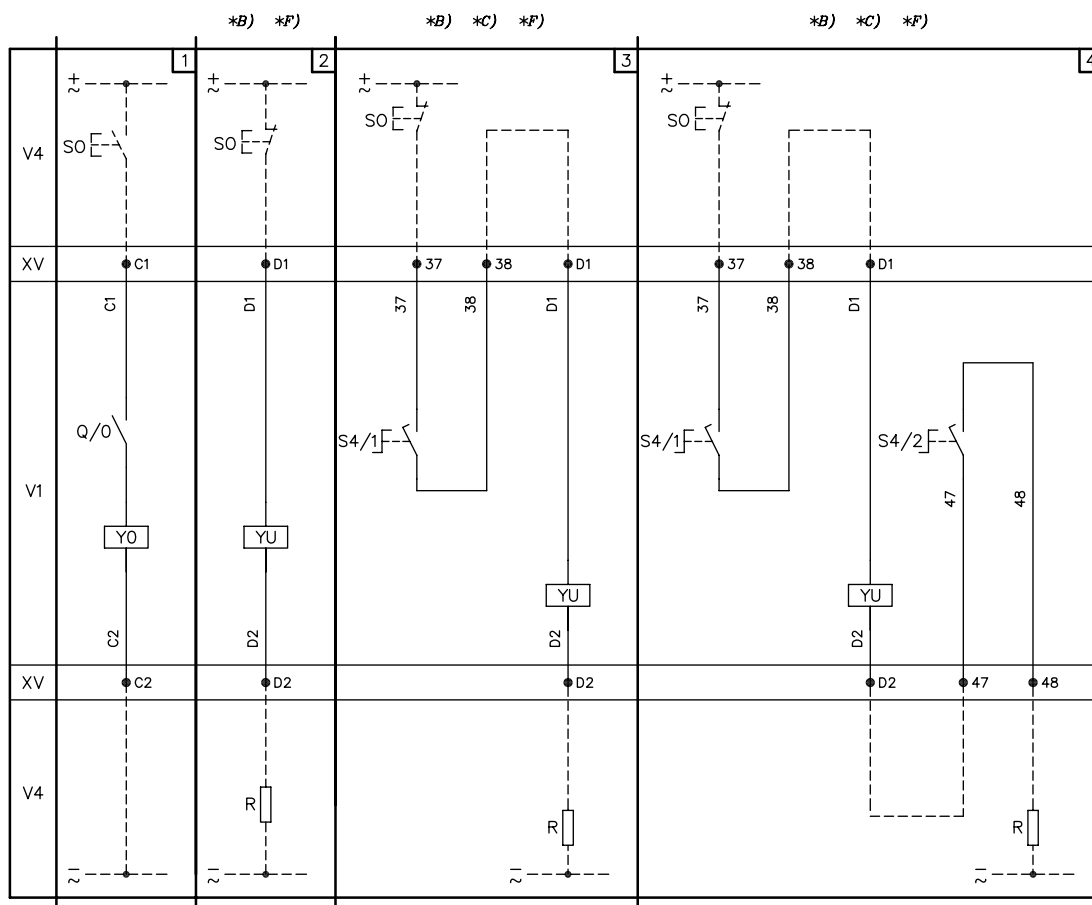


Three-pole circuit-breaker  
with thermal-magnetic trip unit

**Caption**  
Q = Main circuit-breaker

# Electrical accessories

## Shunt opening and undervoltage releases A1 A2



### Figure:

- 1) Shunt opening release (SOR-C or YO)
- 2) Undervoltage release (UVR-C or YU)
- 3) Instantaneous undervoltage release with an early contact in series (AUE-C+UVR-C)
- 4) Instantaneous undervoltage release with two early contacts in series (AUE-C+UVR-C)

### Notes

- B) 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 energized (the lock on closing is made mechanically).
- C) The S4/1 and S4/2 contacts shown in figures 3–4 open the circuit with circuit-breaker open and close it when a manual closing command is given by means of the rotary handle in accordance with the Standards regarding machine tools (closing does not take place in any case if the undervoltage release is not supplied).
- F) Additional external undervoltage resistor supplied at 250 V DC.

### Caption

- Q/0 = Circuit-breaker auxiliary contacts  
 R = Resistor (see note F)  
 S4/1-2 = Early auxiliary contacts activated by the rotary handle of the circuit-breaker (see note C)  
 SO = Pushbutton or contact for opening the circuit-breaker  
 V1 = Circuit-breaker applications  
 V4 = Indicative apparatus and connections for control and signaling, outside the circuit-breaker  
 XV = Terminal boards of the applications  
 YO = Shunt opening release (SOR-C)  
 YU = Undervoltage release (UVR-C) (see notes B and C)



Auxiliary contacts A1 A2

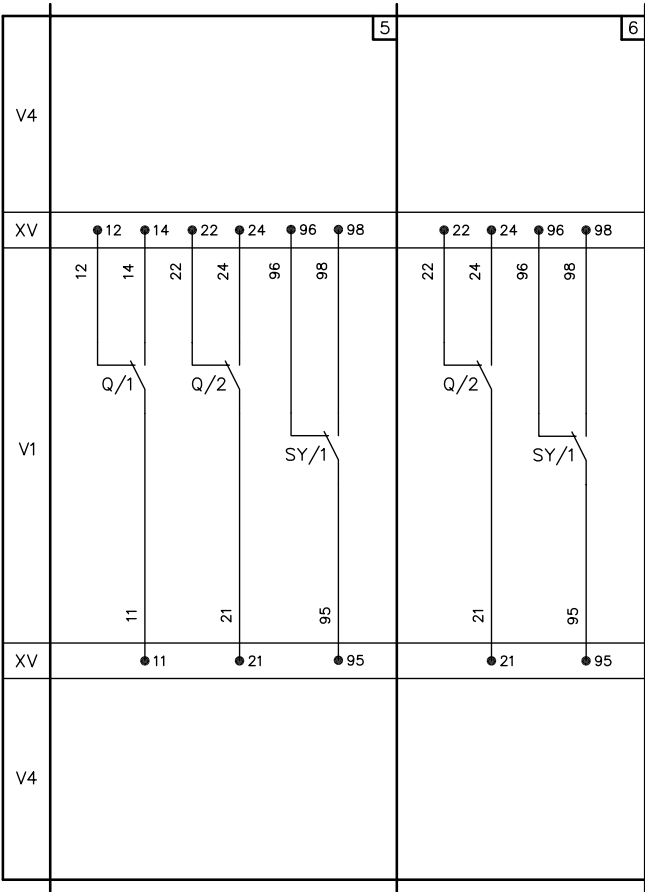


Figure:

- 5) Two changeover contacts for electrical signaling of circuit-breaker open/closed and one changeover contact for signaling circuit-breaker in tripped position due to thermal-magnetic trip unit or SOR-C or UVR-C intervention (2Q+1SY)
- 6) One changeover contact for electrical signaling of circuit-breaker open/closed and one changeover contact for signaling circuit-breaker in tripped position due to thermal-magnetic trip unit or SOR-C or UVR-C intervention (1Q+1SY)

Caption

- Q/1, 2 = Circuit-breaker auxiliary contacts
- SY = Contact for electrical signaling circuit-breaker open due to trip of the thermal-magnetic trip unit YO (SOR-C), YU (UVR-C) (tripped position)
- V1 = Circuit-breaker applications
- V4 = Indicative apparatus and connections for control and signaling, outside the circuit-breaker
- XV = Terminal boards of the applications







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