
FAQ

Answers on regulations, application fields and installation methods for MCBs

Questions and answers

This FAQ is valid for the present design according to the standards as written in the data sheets. A change of the design could make this FAQ invalid.

Please always refer to our latest global catalogues editions as the main source of updated information!

Table of Contents

1.	How does ambient temperature affect MCBs performances?	3
2.	How does altitude affect MCBs performances?	3
3.	How does network frequency affect MCBs performances?	3
4.	How does multiple devices influence each other?.....	3
5.	Which is the tripping time of ABB MCBs?	4
6.	Which are the rated voltage and the minimum operating voltage of ABB MCBs?	4
7.	Are ABB MCBs suitable for isolation?	5
8.	Are ABB MCBs certified as not flammable?.....	5
9.	Can ABB MCBs be used in DC-networks?	5
10.	What is “let-through energy”? Why is it important?	5
11.	What is back-up?	5
12.	What is selectivity?.....	6
13.	Which accessories are compatible with ABB MCBs?	6
14.	Which is the MTTF, MTBF, FIT for ABB MCBs?	6
15.	Certificates, declarations, approvals and confirmations	7
16.	Definitions by standard.....	7
16.1.	Are there any application specific product standards?	7
16.1.1.	IEC/EN 60898-1	7
16.1.2.	IEC/EN 60947-2	7
16.1.3.	UL 1077.....	8
16.2.	How to understand the voltage types of a device?	8
16.2.1.	Rated insulation voltage (Ui) according IEC/EN 60664-1.....	8
16.2.2.	Rated operational voltage (Ue) acc.to IEC/EN 60898-1	8
16.2.3.	Rated operational voltage (Ue) acc.to IEC/EN 60947-2	8
16.2.4.	Max. power frequency recovery voltage (Umax) acc.to IEC/EN 60947-2	8
16.2.5.	Rated impulse withstand voltage (Uimp).....	9
16.3.	How to understand the breaking capacity of a device?	9
16.3.1.	Rated short-circuit capacity (Icn) acc.to IEC/EN 60898-1	9
16.3.2.	Rated service short-circuit breaking capacity (Ics) acc.to IEC/EN 60947-2	9
16.3.3.	Rated ultimate short-circuit breaking capacity (Icu) acc.to IEC/EN 60947-2	9

1. How does ambient temperature affect MCBs performances?

In general, the MCB rated current value refers to a temperature of 20 °C for circuit-breakers with characteristics K and Z and 30 °C for characteristics B, C and D. However, calibration temperature may vary for specific ranges (e.g S280 UC FS, S200MTR).

For further details, please always refer to the latest derating tables from our technical catalogue, [here](#).

2. How does altitude affect MCBs performances?

Up to the height of 2000 m, MCBs do not undergo any alterations in their rated performances. Over this height the properties of the atmosphere change in terms of composition, dielectric capacity, cooling capacity and pressure, therefore the performances of the MCBs undergo derating, which can basically be measured in terms of variations in significant parameters, such as the maximum operating voltage and the rated current according to the following table:

Altitude	[m]	2000	3000	4000	5000
Rated voltage (U_n)	[V]	U_n	$0.887 \cdot U_n$	$0.775 \cdot U_n$	$0.676 \cdot U_n$
Rated current (I_n)	[A]	I_n	$0.96 \cdot I_n$	$0.93 \cdot I_n$	$0.90 \cdot I_n$

The derating of the rated voltage is valid for AC and DC voltages.

Latest derating tables can be found on technical catalogue, [here](#).

3. How does network frequency affect MCBs performances?

Thermal tripping performance is unaffected by network frequency.

For electromagnetic tripping refer to the following table:

	AC			DC
	100 Hz	200 Hz	400 Hz	
Multiplier	1.1	1.2	1.5	1.5

Latest derating tables can be found on technical catalogue, [here](#).

4. How does multiple devices influence each other?

In case of dense sequence of uniformly high load devices, a correction factor must be accounted for the rated current:

Number of devices	1	3	5	≥ 6
Correction factor	1	0.9	0.8	0.75

Latest derating tables can be found on technical catalogue, [here](#).

5. Which is the tripping time of ABB MCBs?

Tripping characteristics of MCBs can be found on ABB technical catalogue, [here](#).

As an example, regarding S200, S200 M, S200 P, S200 S, S200 MUC, SN201 L, SN201, SN201 M refer to the following table:

Tripping characteristics S 200 / S 200 M / S 200 P / S 200 S / S 200 MUC / SN 201 L / SN 201 / SN 201 M								
Acc. to	Tripping characteristic and rated current	Thermal release ②			Electromagnetic release ①		Tripping time	
		Current:	Tripping time	Currents:	Tripping time			
		conventional non-tripping current	conventional tripping current		hold current surges	trip at least at		
IEC/EN 60898-1	B	6 to 63 A	$1.13 \cdot I_n$	$> 1 \text{ h}$	$3 \cdot I_n$	$> 0.1 \text{ s}$		
				$1.45 \cdot I_n$	$< 1 \text{ h}$	$5 \cdot I_n$	$< 0.1 \text{ s}$	
	C	0.5 to 63 A	$1.13 \cdot I_n$	$> 1 \text{ h}$	$5 \cdot I_n$	$> 0.1 \text{ s}$		
				$1.45 \cdot I_n$	$< 1 \text{ h}$	$10 \cdot I_n$	$< 0.1 \text{ s}$	
	D	0.5 to 63 A	$1.13 \cdot I_n$	$> 1 \text{ h}$	$10 \cdot I_n$	$> 0.1 \text{ s}$		
				$1.45 \cdot I_n$	$< 1 \text{ h}$	$20 \cdot I_n$	$< 0.1 \text{ s}$	
IEC/EN 60947-2	K	0.2 to 63 A	$1.05 \cdot I_n$	$> 1 \text{ h}$	$10 \cdot I_n$	$> 0.2 \text{ s}$		
				$1.2 \cdot I_n$	$< 1 \text{ h}$ ③	$14 \cdot I_n$	$< 0.2 \text{ s}$	
				$1.5 \cdot I_n$	$< 2 \text{ min.}$ ③			
				$6.0 \cdot I_n$	$> 2 \text{ s (T1)}$			
	Z	0.5 to 63 A	$1.05 \cdot I_n$	$> 1 \text{ h}$	$2 \cdot I_n$	$> 0.2 \text{ s}$		
				$1.2 \cdot I_n$	$< 1 \text{ h}$ ③	$3 \cdot I_n$	$< 0.2 \text{ s}$	

① The indicated electromagnetic tripping values apply to a frequency range of 16.2/3 ... 60 Hz. For different network frequencies or direct current the values change according to the multiplier in the table below

② The thermal releases are calibrated to a nominal reference ambient temperature; for Z and K, the value is 20 °C, for B and C = 30 °C. In the case of higher ambient temperatures, the current values fall by ca. 6 % for each 10 K temperature rise.

③ As from operating temperature (after $I_n > 1 \text{ h}$ or, as applicable, 2 h).

6. Which are the rated voltage and the minimum operating voltage of ABB MCBs?

Please always refer to the catalogue data as the latest updated source of information for all MCBs. As an example, for the S200:

The rated operational voltage (Ue) according to IEC/EN 60898-1 is:

- 230/400 V AC, 1 phase devices
- 230 V AC, 1 phase + neutral devices
- 400 V AC, 2, 3, 4 phases devices
- 400 V AC, 3 phases + neutral devices

The rated operational voltage (Ue) according to IEC/EN 60947-2 is:

- 230 V AC, 1 phase devices
- 230 V AC, 1 phase + neutral devices
- 440 V AC, 2, 3, 4 phases devices
- 440 V AC, 3 phases + neutral devices

The minimum operational voltage is 12 V AC, 12 V DC. The minimum rated voltage is the value at which contact safety is ensured. At lower voltages, the current flow may be interrupted, even if the contacts are closed.

Latest technical data can be found on technical catalogue, [here](#).

7. Are ABB MCBs suitable for isolation?

MCBs are suitable for isolation if compliant with the product standard IEC/EN 60898-1. Please always refer to the global catalogue data as the latest source of information for each range.

8. Are ABB MCBs certified as not flammable?

Materials used for ABB MCB's fulfil various requirements regarding fire exposure. Depending on the MCB type, e.g. the UL94 fulfilment can vary between V0 and V2. Product specific details can be found on our global product catalogue datasheets [here](#).

For dedicated fire and smoke applications, there are special MCBs with specific certificates. (e.g. in transportation the S200MT, S200MTUC, S800S, S800S-UC).

Fire certificates and declarations can be released only upon request.

9. Can ABB MCBs be used in DC-networks?

Please always refer to the catalogue data as the latest updated source of information for all MCBs, also for DC values.

As an example, the S200 can be used in DC-applications up to $U_{max} = 72$ VDC for 1P devices and up to 125 VDC, with 2 poles connected in series. In this case the maximum voltage per pole shall not exceed 62.5 VDC under normal conditions.

There are also dedicated universal current products with a high DC performance (e.g S200M UC, S200MT UC, S200MTR DC, S800S-UC)

10. What is "let-through energy"? Why is it important?

Tripping of an installation circuit by a circuit-breaker when there is a short-circuit requires a certain amount of time depending on the characteristics of the circuit-breaker and the entity of the short-circuit current. During this period of time, some or all of the short-circuit current flows into the installation.

Considering this, the parameter I^2t defines the "specific let-through energy". Which can be intended as the specific energy that the breaker allows through when there is a short-circuit current I_{cc} during the tripping time t . In this way, we can determine the capacity of a circuit-breaker to limit it by reducing the peak value of the above-mentioned currents to a value which is considerably lower than the estimated current. And therefore, it highly contributes to cable protection and avoid the risk of considerable damages to electrical installations.

Further information, also regarding the relation between let through energy and cable material, can be found on our technical catalogue, [here](#).

11. What is back-up?

Whenever the short circuit current is higher than the value a device is able to switch off (or withstand without damages), a further back-up protection for such device is needed. This

protection is obtained by an associated upstream short-circuit protection device in such a way that there is no impermissible overload or damage.

Additional information, as well as back-up coordination tables, can be found on technical catalogue [here](#).

12. What is selectivity?

Selectivity occurs when the switch off, in case of an automatic shutdown due to a fault in the electrical system or an equipment, affects the only protective device which is immediately upstream of the fault. Further protective devices, which are upstream on the feed-in side or those that supply parallel circuits, remain switched on, so that only the smallest possible part of the electrical system is separated from the grid.

Additional information, as well as selective coordination tables are available in the technical catalogue [here](#) as well as the SOC tool:

<https://www.lowvoltage-tools.abb.com/soc/>

13. Which accessories are compatible with ABB MCBs?

- Auxiliary contacts
- Signal/Auxiliary contacts
- Disconnectable neutral
- RCD Block
- Busbar System
- Rotary Drive
- Rotary Handle
- Intermediate piece
- Padlock Device
- Undervoltage Release
- Short-circuit current limiter with self resetting
- Shunt trip
- Undervoltage releases
- Overvoltage releases
- Mechanical tripping device
- Switched neutral
- Motor operating devices

The whole list of accessory combinations might vary depending on the specific MCB range. Details can be found in the ABB catalogue [here](#), as well as in the dedicated selection tables.

14. Which is the MTTF, MTBF, FIT for ABB MCBs?

A MTTF (Mean-Time-To-Failure) rate cannot be published as this value depends on the ambient temperature, environmental conditions, frequency of operation and the load profile of the device.

The MTBF (Mean-Time-Between-Failure) rate is analog to the MTTF for repairable products. As our products are not repairable this is not valid.

The FIT (Failure in Time) rate describes the failure rate of technical components. For our protection devices a FIT rate of 100 can be used in calculations where 1 FIT is equal to 1 failure in 10^9 hours.

As an example, S200 and S200M exceed by far the values requested by the applicable standards i.e. IEC60898-1 and IEC/EN60947-2, i.e. under normal condition:

- life \gg 10 years and / or
- 20.000 mechanical I/O-operations at nominal load for ratings $<$ 32A
- 10.000 mechanical I/O-operations at nominal load for ratings $>$ 32A

whatever is earlier. The MCBs are maintenance-free.

They tolerate without tripping:

- Impact resistance: 25g, minimum of 2 impacts
- Vibration resistance: 5 g, 5 ... 150 ... 5 Hz, 20 cycles at 0,8 I_{nom} acc. to IEC/EN60068-2-6

15. Certificates, declarations, approvals and confirmations

Available documents for each range can be found on the related product detail pages (e.g. available documents of S200 and S200M can be found [here](#), available documents for S800 can be found [here](#)).

Any declaration, certificate, approval or confirmation not available in product detail pages are possibly released only upon request.

16. Definitions by standard

16.1. *Are there any application specific product standards?*

16.1.1. *IEC/EN 60898-1*

Miniature Circuit Breakers according IEC/EN 60898-1 are intended for the protection against overcurrents of wiring installations of buildings and similar applications; they are designed for use by uninstructed people and for not being maintained. This part of IEC/EN 60898 applies for a.c. airbreak circuit-breakers for operation at 50 Hz or 60 Hz, having a rated voltage not exceeding 440 V (between phases), a rated current not exceeding 125 A and a rated short-circuit capacity not exceeding 25.000 A. As far as possible, it is in line with the requirements contained in IEC/EN 60947-2.

16.1.2. *IEC/EN 60947-2*

This part of the IEC/EN 60947 applies to circuit-breakers, the main contacts of which are intended to be connected to circuits, the rated voltage of which does not exceed 1.000 V a.c. or 1.500 V d.c.. It applies whatever the rated currents, the method of construction or the proposed applications of the circuit breakers may be. The circuit-breakers are designed for use by instructed people.

16.1.3. UL 1077

These requirements apply to supplementary protectors intended for use as overcurrent, or over- or under-voltage protection within an appliance or other electrical equipment where branch circuit overcurrent protection is already provided or is not required. Compliance with this standard is acceptable for use as a component of an end product.

16.2. How to understand the voltage types of a device?**16.2.1. Rated insulation voltage (U_i) according IEC/EN 60664-1**

Root mean square (R.M.S.) or DC withstand voltage value assigned by the manufacturer to the equipment or to a part of it, characterizing the specified (long-term) withstand capability of its insulation.

The rated insulation voltage (U_i) of the device is the value of the voltage to which the dielectric test voltage and the creepage distances are referred. The rated operational voltage shall not exceed the rated insulation voltage.

16.2.2. Rated operational voltage (U_e) acc.to IEC/EN 60898-1

The rated voltage of a circuit-breaker is the value of voltage, assigned by the manufacturer, to which its performance (particularly the short-circuit performance) is referred. The same circuit-breaker may be assigned a number of rated voltages and associated rated short-circuit capacities. The voltage which appears across the terminals of a pole of a circuit-breaker after the breaking of the current. The value of the power frequency recovery voltage shall be equal to 110% of the rated voltage of the circuit-breaker under test.

16.2.3. Rated operational voltage (U_e) acc.to IEC/EN 60947-2

The rated operational voltage of an equipment is a value of voltage which, combined with a rated operational current, determines the application of the equipment and to which the relevant tests and the utilization categories are referred. For single-pole equipment it is generally stated as the voltage across the pole. For multi pole equipment it is generally stated as the voltage between phases. An equipment may be assigned a number of combinations of rated operational voltage and associated making and breaking capacities for different duties and utilization categories.

16.2.4. Max. power frequency recovery voltage (U_{max}) acc.to IEC/EN 60947-2

Voltage which appears across the terminals of a pole of a switching device after the breaking of the current. For all breaking capacities and short-circuit breaking capacity tests, the value of the power-frequency recovery voltage shall be 105% of the value of the rated operational voltage. This value shall be within the specified tolerance (voltage 0 / + 5%). The value of 1.05 times the rated operational voltage for the power frequency recovery voltage, together with the test voltage tolerance resulting in a maximum voltage of 1.1 times the rated operational voltage, is deemed to cover the effects of variations of the system voltage under normal service conditions.

16.2.5. Rated impulse withstand voltage (U_{imp})

The **rated impulse withstand voltage (U_{imp})** depends on the overvoltage category and the nominal voltage of the installation. The rated impulse withstand voltage is the peak value of the voltage at 2.000 m above sea level. As the barometric pressure de-creases at higher altitude, the tests are performed with higher test voltages at lower altitudes. If the devices are suitable for isolation, an additional factor applies. The de-vices are usually installed in fixed installations where overvoltage category III applies. With a nominal voltage of the supply system of 230/400 V AC the corresponding rated impulse withstand voltage is 4 kV which leads to a test voltage of 6.3 kV at sea level and 5kV at 2.000m.

16.3. How to understand the breaking capacity of a device?

16.3.1. Rated short-circuit capacity (I_{cn}) acc.to IEC/EN 60898-1

The rated short-circuit capacity of a circuit-breaker is the value of the ultimate short-circuit breaking capacity assigned to that circuit-breaker by the manufacturer. The sequence of operations shall be: O – t – CO*. The following symbols are used for defining the sequence of operations:

- O: represents an opening operation
- CO: represents a closing operation followed by an automatic opening
- t: represents the time interval between two short-circuit operations

16.3.2. Rated service short-circuit breaking capacity (I_{cs}) acc.to IEC/EN 60947-2

The rated service short-circuit breaking capacity of a circuit-breaker is the value of service short-circuit breaking capacity assigned to that circuit-breaker by the manufacturer for the corresponding rated operational voltage. It is expressed as a value of prospective breaking current, in kA, corresponding to one of the specified percentages of the rated ultimate short-circuit breaking capacity and rounded up to the nearest whole number. It may be expressed as a % of I_{cu} (for example $I_{cs} = 25\% I_{cu}$). The sequence of operations shall be: O – t – CO – t – CO. The following symbols are used for defining the sequence of operations:

- O: represents an opening operation
- CO: represents a closing operation followed by an automatic opening
- t: represents the time interval between two short-circuit operations

16.3.3. Rated ultimate short-circuit breaking capacity (I_{cu}) acc.to IEC/EN 60947-2

The rated ultimate short-circuit breaking capacity of a circuit-breaker is the value of ultimate short-circuit breaking capacity assigned to that circuit-breaker by the manufacturer for the corresponding rated operational voltage. It is expressed as the value of the prospective breaking current, in kA (r.m.s. value of the a.c. component in the case of a.c.). The sequence of operations shall be: O – t – CO. The following symbols are used for defining the sequence of operations:

- O: represents an opening operation
- CO: represents a closing operation followed by an automatic opening
- t: represents the time interval between two short-circuit operations