
FAQ

Answers on regulations, application fields and installation methods for Type B RCCBs

Questions and answers

1. How could a high-frequency residual current affect the proper operation of Type A RCCBs?

Depending on the specific case, Type A RCCBs could present the following drawbacks:

- they may not trip in case of fault current to ground with a high continuous component or a high frequency (or they may trip late or at excessive residual current values)
- the RCCB may become desensitized and therefore not trip within the established limits should another piece of equipment fail (even if this fault has a sinusoidal alternating form)
- nuisance tripping with no fault condition.

2. Which types of residual currents set in the Standard EN 62423 are tested on Type B RCCBs?

The residual current tripping waveforms required by the standards for Type B are:

- sinusoidal alternating current at mains frequency
- pulsating unidirectional current, with or without phase angle
- unidirectional current generated by two or three-phase rectifiers
- sinusoidal alternating current up to a frequency of 1 kHz
- direct current without ripple
- current obtained by the overlap of direct current on alternating current
- current obtained by the overlap of direct current on pulsating unidirectional current
- current obtained by the overlap of several frequencies.

3. Which standards define Type B RCCBs?

The Standard EN 62423, "Type F and B RCCBs with or without integral overcurrent protection for household and similar uses", must be used in conjunction with the Standard IEC EN 61008 or IEC EN 61009, since it contains only the requirements and tests in addition to those set out in the aforesaid standards for Type A residual current circuit breakers. For industrial applications only, the Standard IEC EN 60947-2 must be added to the aforesaid standards.

4. When do the Standards require Type B RCCBs?

- In photovoltaic systems that do not have at least a simple separation between the AC side and the DC side, if the converter is not exempt by construction design from injecting direct ground fault currents into the electrical system, one must install a Type B RCCB on the AC side
- in group 1 and group 2 rooms for medical use, only Type A or Type B RCCBs must be used according to the type of possible fault current
- when STS and UPS devices are used and the project includes the possibility of fault current to ground with direct current components, their installation instructions must state that the building's RCCBs must be as follows: Type B for UPS and three-phase STS devices; Type A for single-phase STS devices (see IEC EN 62040-1 Art. 4.7.12 and IEC EN 62310-1 Art. 4.1.10)
- when electric vehicles are charged with a three-phase power supply, one must use protection measures that are sensitive to ground fault currents, for example a Type B RCCB
- more in general, regarding the correct choice of RCCBs for power electronics equipment other than the cases indicated above, please refer to the Standard IEC EN 50178 "Electronic equipment for use in power installations", Art. 5.2.11.2, which states: mobile electronic equipment with allocated power > 4 kVA or fixed electronic equipment of any power that is not compatible with Type A RCCBs must be provided with a warning on the equipment and in the operating manual to require the use either of a Type B RCCB or of another protection method (e.g. isolation transformer).

5. What is the correct installation?

Please refer to [ABB White Paper](#)

6. Which is the operative range temperature of Type B RCCBs?

The operative range is defined according to the system current:

- -25°C +70°C if system current \leq 32 A
- -25°C +65°C if system current = 40 A
- -25°C +50°C if system current = 63 A

- Other system current can be found on dedicated derating tables, in technical catalogue, [here](#).

The operative range temperature for F200 B Type high ratings is -25°C +40°C.

7. How do you coordinate with the grounding system to provide protection against indirect contact at high frequencies?

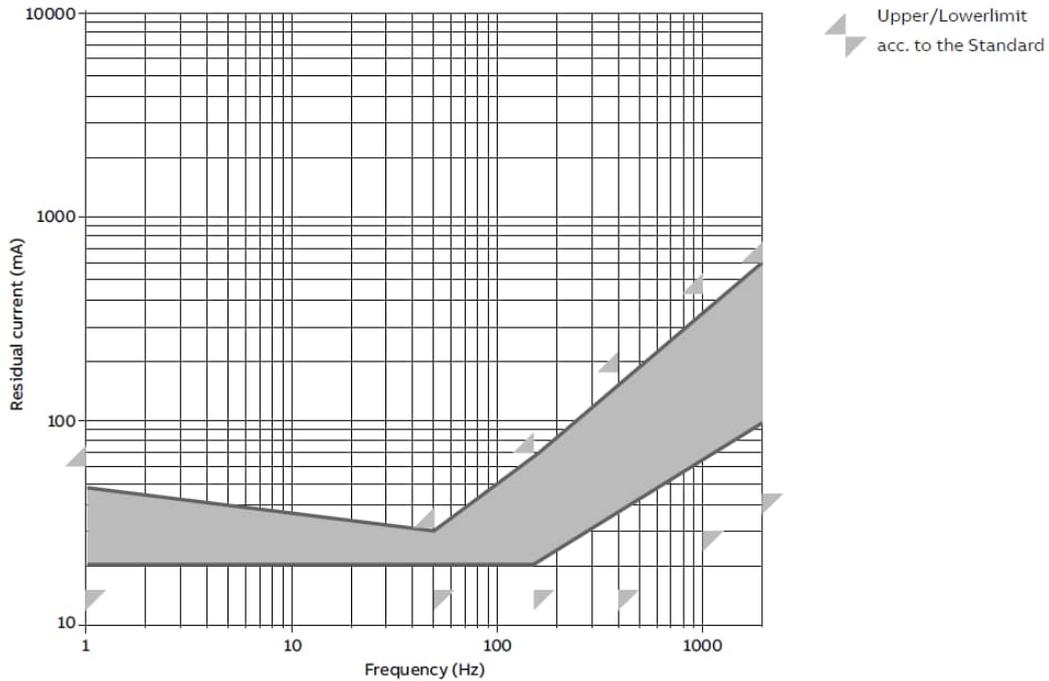
To provide protection against indirect contact in TT systems, the circuit breaker must be coordinated with the resistance of the grounding system with the customary ratio:
 $RE I_{\Delta n} \leq 50 \text{ V}$

With this coordination ratio the protection against indirect contact is automatically checked in the case of direct current faults, since the permissible limit contact voltage in direct current is 120 V, which corresponds to 50 V in alternating current.

In the case of high-frequency faults, however, a permissible limit contact voltage has not yet been established at the regulatory level. Although the risks for the human body decrease as the frequency increases, until the standards have set these values, the Standard IEC EN 62423 recommends as a precautionary measure to maintain unchanged the value of 50 V also at higher frequencies. To do this, it is necessary to consider the actual tripping value of a possible fault frequency. For example, in the case of a Type B circuit breaker, whose tripping characteristic is shown in following figure, at 1,000 Hz tripping is guaranteed with a residual current slightly lower than 400 mA (lower than the regulatory limit of 420 mA). Therefore, if the power consuming equipment can generate a fault current of 1,000 Hz, the ground resistance must meet the ratio

$$RE \cdot 0,3 \text{ A} \leq 50 \text{ V}$$

$$\text{i.e. } RE \leq 166 \Omega$$

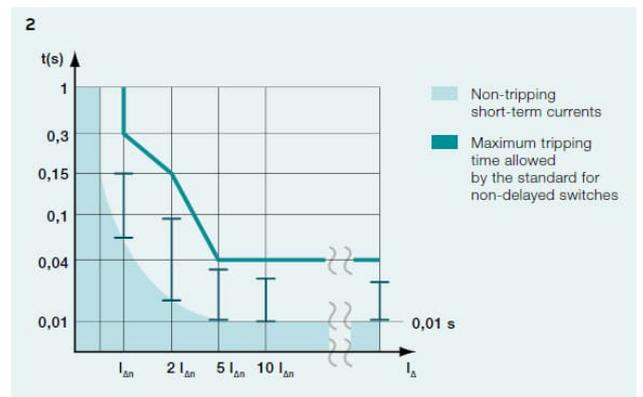
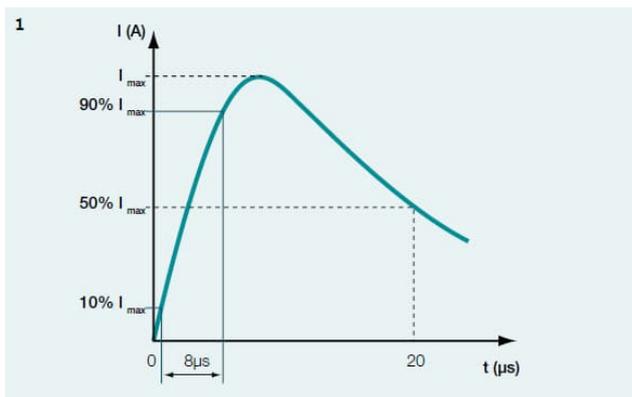


Frequency tripping curve of F200 Type B 30mA RCCBs

8. How the unwanted tripping of Type B RCCBs is guaranteed?

To prove their immunity to unwanted tripping, Type B residual current devices must successfully pass further severe tests such as:

- 8/20 μ s impulse up to 3000 A
- 10 ms impulse up to $10 I_{\Delta n}$



These tests emulate the conditions that B Type RCCBs must withstand in case of over-voltages or leakages due to EMC filters or electronic loads. Type B and devices can be considered suitable for all difficult applications, not only in terms of protection, but of operational continuity as well.

Intervention time can be found according to the table:

Tripping times					
Type	Fault currents	Tripping time at			
	Alternating currents	1 x I Δ n	2 x I Δ n	5 x I Δ n	500 A
	Pulsating DC currents	1,4 x I Δ n	2 x 1,4 x I Δ n	5 x 1,4 x I Δ n	500 A
	Smooth DC currents	2 x I Δ n	2 x 2 x I Δ n	5 x 2 x I Δ n	500 A
Standard or short-time delay		Max. 0,3 s	Max. 0,15 s	Max. 0,04 s	Max. 0,04 s
Selectiv S		0,13 - 0,5 s	0,06 - 0,2 s	0,05 - 0,15 s	0,04 - 0,15 s

9. How's insulation test performed for F200 Type B 16-63 A RCCBs?

It is possible to perform the insulation test (up to 1000 V DC) without disconnecting the neutral. However, in order to have no influence on the result of insulation test, if the device is supplied from upstream, it is necessary to set the toggle in OFF position and then unplug the terminal 2-4-6-8; on the other hand, if the device is supplied from downstream, it is enough to set the toggle in OFF position and no cable disconnection is required.

10. What will be happened if the F200 Type B 16-63 A RCCB is supplied from upstream and it is not possible to disconnect the cables due to the installation configuration?

If the RCCB is supplied from top and it is not possible to disconnect it while performing the insulation test, the RCCB will not be damaged but insulation measurement will be influenced.

11. Are F200 Type B RCCBs compatible with F2C-ARI?

Yes, F200B up to 63 A is compatible with F2C-ARI. Compatibility with all accessories can be found on [ABB catalogue](#) by looking at dedicated selection tables.

12. Which information is given by the frontal LED when the F200 Type B 16-63 A RCCB is installed?

The frontal LED shows the device status.

If the LED is on (Green) and the RCCB is in closed position, it indicates that the voltage is enough for the device to operate as type B ($V > 50V$).

If the RCCB is in closed position and the LED is off, only sinusoidal alternating currents (type AC) up to 2 kHz, pulsating unidirectional currents (type A) and multi-frequency currents (type F) are detected. The DC current detection is not active

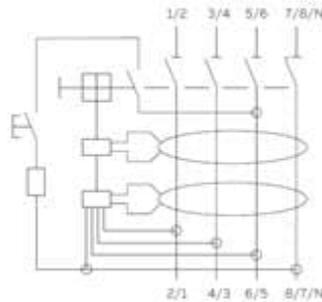
13. How does the self-diagnostic perform?

The self-diagnostic functionality of F200 Type B 16-63 A RCCBs guarantees a continuous check of the status of the DC fault currents detection path: each few second, an

internal micro-controller can verify the status of the main electronic components as well as the firmware integrity of the Voltage Dependent PCBA. If the self-diagnostic detects a malfunctioning, the RCD will trip.

14. Is it possible to use F204 Type B RCCBs, up to 63 A, in a three-phase network with no neutral?

Yes, but it is necessary to guarantee the correct functioning of the test button. In fact, the test button circuit of an RCCBs 4P F200 is wired between terminal 5/6 and 7/8/N as indicated in the diagram below and is designed for operation between 110 and 254 V (RCCB 30 mA: 170 und 254 V AC).

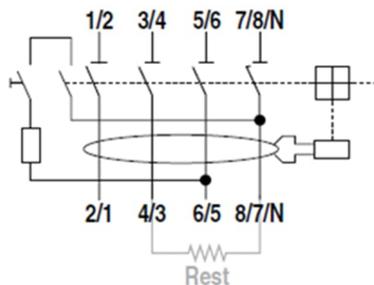


If the concatenate voltage is between 110V (170V for the 30mA version according to EN standard) and 254 V (277 V according to UL 1053) for the correct working of the test button there are two possible solutions:

1. connect the 3 phases to the terminals 3/4 5/6 7/8/N and the terminals 4/3 6/5 8/7/N (supply and load side respectively)
2. connect the 3 phases normally (supply to terminals 1/2 3/4/5/6 and load to terminals 2/1 4/3 6/5), bridging terminal 1/2 and 7/8/N

If concatenate voltage higher than 254 V, connect normally the phases (supply to terminals 1/2 3/4/5/6 and load to terminals 2/1 4/3 6/5), bridge terminal 4/3 and 8/7/N with an electric resistance according to the table.

Test resistance must have a power loss higher than 4 W.



Idn	[A]	0,03	0,1	0,3	0,5
Test	[Ω]	3900	2200	2200	2200

To avoid malfunctions such as avoided tripping it is necessary to install test resistances with the lowest possible variation with respect to those indicated.

15. Certificates, declarations, approvals and confirmations

Available documents of F200 B Type RCCBs can be found [here](#).

Any declaration, certificate, approval or confirmation not available in previous links is possibly released only upon request.