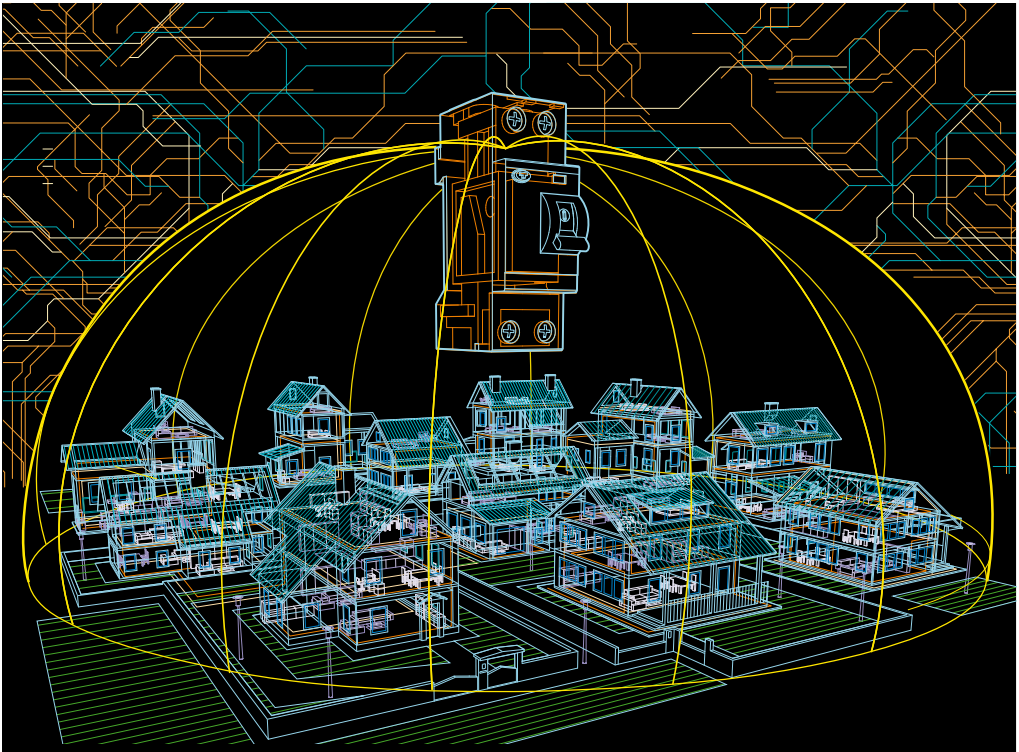


RCDs: the best way to guarantee eletrical safety at home

How they can protect from electric shock and fire

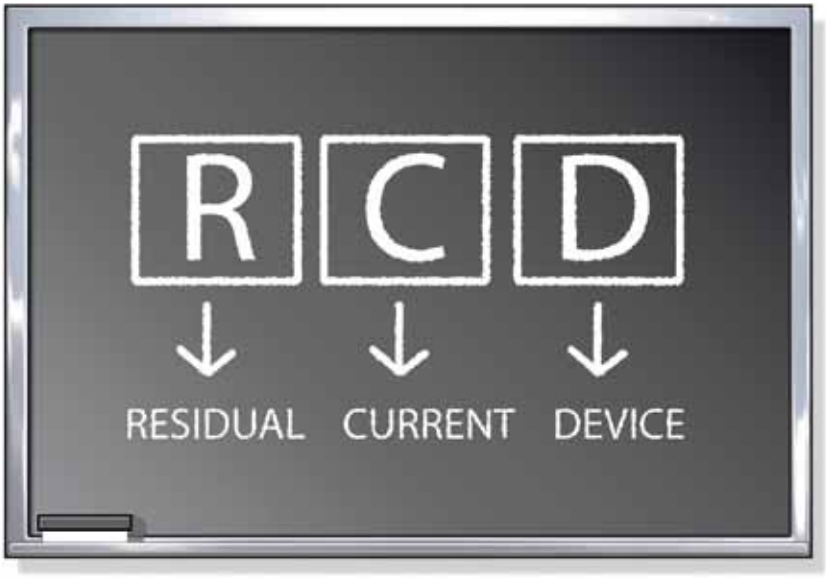
Power and productivity
for a better world™

Introduction

Every year al lot of people die and/or is injured in electrical accidents at home. No everyone knows that many injuries and deaths could be prevented by having RCD protection installed in the house consumer unit.

RCD protection can save lives by protecting you and your family from fatal electric shock and can provide some protection against fire.

RCD protection will switch off the electricity in a fraction of a second if you get an electric shock. Having a modern consumer unit fitted with RCDs gives you the best protection because they usually cover all the wiring, sockets and appliances in your home.

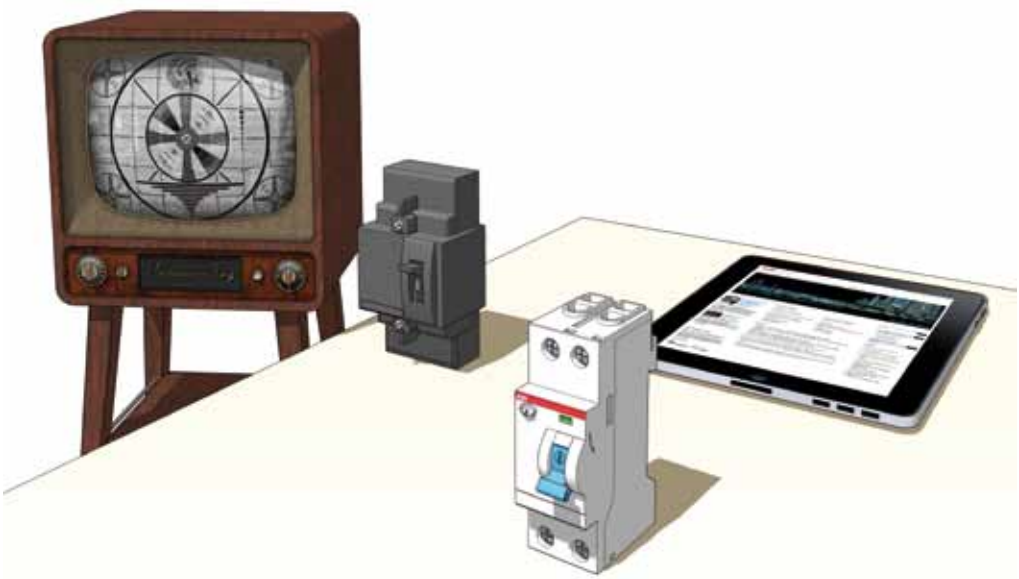


The blackboard simply explains the meaning of the acronym RCD that stands for Residual Current Device

Brief history

ABB has always played a main role in the development of Residual Current Devices introducing on the market with ever more innovative devices to satisfy the requirements. At today RCDs are widely used all over the world and ensure high safety in the use of electrical equipment.

It is not clear by whom and when it was developed the first RCD but certainly it appeared on the market in the 50s and was initially used by some Utilities to fight the “energy theft” due to the use of currents from phase to the earth instead of phase to neutral.
With this scope, in fact in 1953 ABB built the first RCD low sensitivity and in 1956 a device with high sensitivity. Later Residual Current Devices were adopted to protect people against electric shock.
RCDs are now widely used in most of the world, in some cases are required, while in others their use is optional.



One of the first producers
of RCDs was ABB group.

Regulations

Founded in 1906, the IEC (International Electrotechnical Commission) is the world's leading organization for the preparation and publication of International Standards for all electrical, electronic and related technologies. These are known collectively as "electrotechnology".

All IEC International Standards are fully consensus-based and represent the needs of key stakeholders of every nation participating in IEC work. Every member country, no matter how large or small, has one vote and a say in what goes into an IEC International Standard. IEC standards are recognized by almost all countries of the world.
The IEC standard is recovered in Europe by CENELEC (European Committee for Electrical Standardization) which shall publish the relevant EN standards. Every nation, referring to the CENELEC, transposing and translating EN standards as national standards.

International Electrotechnical Commission: IEC standard

European Committee for Electrotechnical Standardization: EN standard

Every nation, referring to the CENELEC, transposing and translating EN standards as national standards.

Standard IEC 60364 “Electrical Installations for Buildings” is today the main reference for Low-voltage electrical installations in the world. The prescription in term of protection remains as fundamental basis.

The standard has been adopted by many countries, as it is or with local adaptations. Use and regulations differ widely from country to country. Internally, the standards are different in Europe.

At today Residual Current Devices in almost parts of the world are mandatory.

Dangers of electrical current in the human body

Electricity shocks us, because it is an outside force that interferes with the internal electricity that our bodies' nervous systems generate.

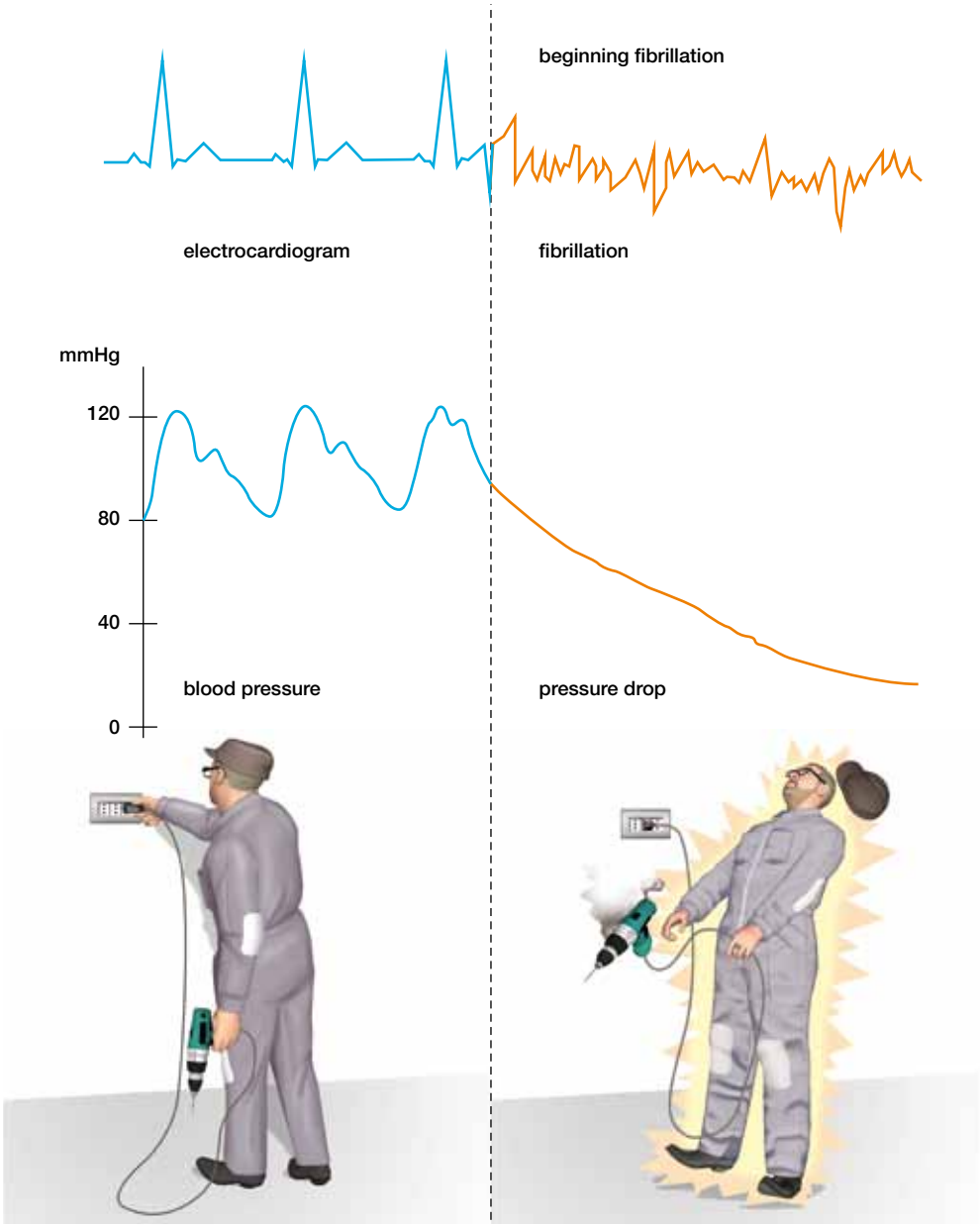
Since the human body consists primarily of water, it provides a superb conductor for electrical energy, or voltage too.

The shocks to our bodies, and the amount of damage the electricity does to them, depends upon the voltage our bodies are subjected to, upon its level of energy, and upon how much our bodies resist the flow of the electrical energy.

Why 30mA is the preferred value for IΔn?

30mA is generally considered a "safe" current through the human body and, whilst you might feel it, it is unlikely to harm or kill you.

When a current exceeding 30 mA passes through a part of a human body, the person concerned is in serious danger if the current is not interrupted in a very short time.


beginning fibrillation
electrocardiogram
fibrillation
mmHg
120
80
40
0
blood pressure
pressure drop

Dangers of electrical current in the human body

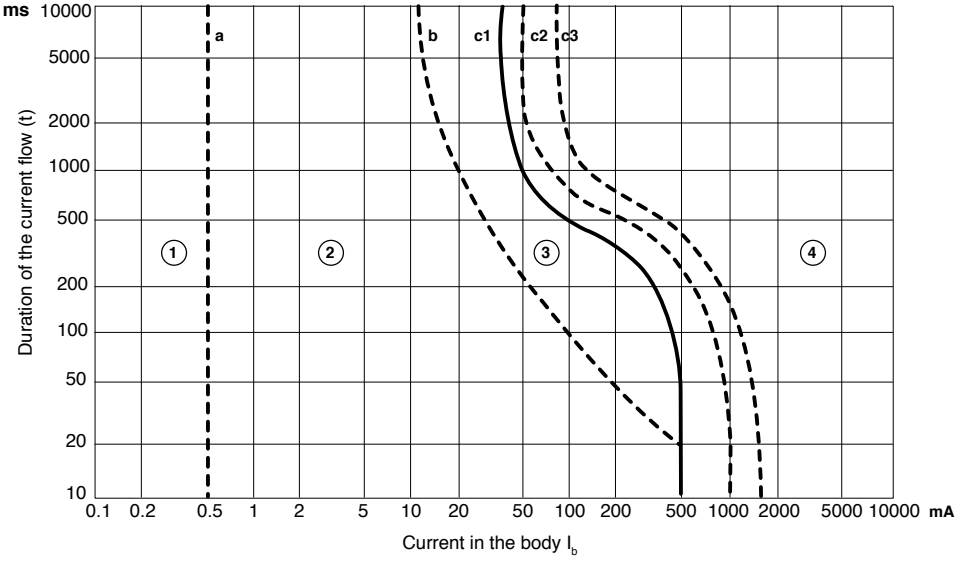
An electric shock is the pathophysiological effect of an electric current through the human body.

Its passage affects essentially the muscular, circulatory and respiratory functions and sometimes results in serious burns. The degree of danger for the victim is a function of the magnitude of the current, the parts of the body through which the current passes and the duration of current flow.

The protection of persons against electric shock in LV installations must be provided in conformity with appropriate national standards and statutory regulations, codes of practice, official guides and circulars, etc. Relevant IEC standards include: IEC 60364 series, IEC 60479 series, IEC 60755, IEC 61008 series, IEC 61009 series and IEC 60947-2.

The Standard IEC 60479-1 “Effects of current on human beings and livestock” is a guide about the effects of current flowing through the human body to be used for the definition of electrical safety requirements. This Standard shows, on a time-current diagram, four zones to which the physiological effects of alternating current (15 – 100 Hz) passing through the human body have been related.

Time-current zones of the effects of alternating current on the human body

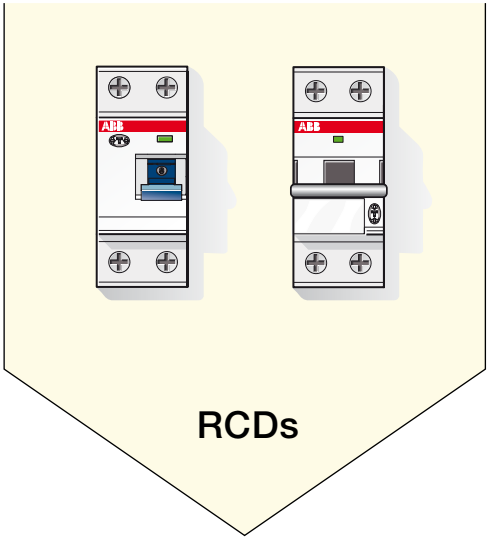


Effects of alternating current on human body

Zone	Effects
1	usually no reaction
2	usually no harmful physiological effects
3	usually no organic damage to be expected. Likelihood of cramp like muscular cotractions and difficulty in breathing; reversible disturbances of formation and conduction of impulses in the heart, including atrial fibrillation and transient cardiac arrest without ventricular fibrillation increasing with current magnitude and time
4	in addition to the effects of zone 3, the probability of ventricular fibrillation increases up to about 5% (curve c2), 50% (curve c3) and above 50% beyond the curve c3. Pathophysiological effects such as cardiac arrest, breathing arrest and severe burns may occur increasing with current magnitude and time

What does an RCD do?

An RCD is a sensitive safety device that switches off electricity automatically if there is a fault.



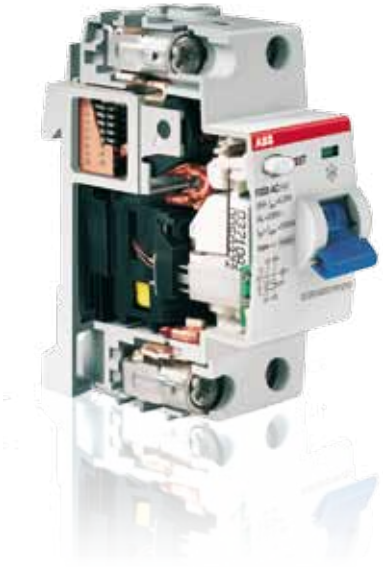
Protect people against electric shock

Protect people and things against electrical fire

How does it work?

An RCD protects by constantly monitoring the current flowing in the live and neutral wires supplying a circuit or an individual item of equipment.

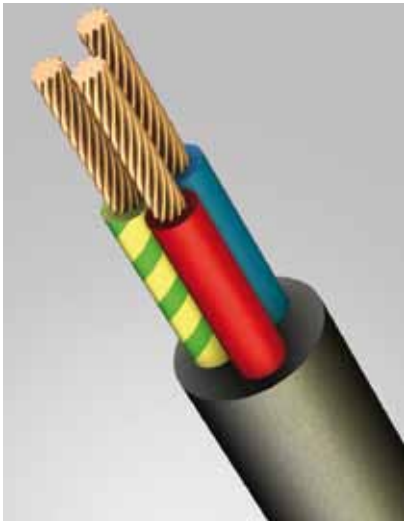
Under normal circumstances, the current flowing in the two wires is equal. When an earth leakage occurs due to a fault in the circuit or an accident with the equipment, an imbalance occurs and this is detected by the RCD, which automatically cuts off the power before injury or damage can result.
So if RCD detects electricity flowing through a person who has touched a live part, the device will switch the circuit off very quickly, significantly reducing the risk of death or serious injury.



Direct contact protection

Direct contact refers to a person coming into contact with a conductor become accidentally live.

The methods of preventing direct contact are mainly concerned with making sure that people cannot touch live conductors.



picture 1

picture 2

These methods include:

- by insulation of live parts (picture 1), this is the standard method;
- by enclosures or barriers to prevent touching;
- by placing out of reach or by obstacles to prevent people from reaching live parts. This protection is reserved only to locations to which skilled or instructed persons only have access;
- the use of Residual Current Devices (RCDs) gives supplementary protection (picture 2), but only when contact is from a live part to an earthed part.

Indirect contact protection

An indirect contact refers to a person coming into contact with an exposed conductive part which is not normally alive, but has become alive accidentally (due to insulation failure or some other cause).

Protection against indirect contact is used to protect people against the dangers resulting from contact with conductive parts which would not normally be live.

The methods of protection against indirect contacts are classified as follows:
- protection by automatic disconnection of supply;
- protection without automatic disconnection of the circuit (double isolation, electrical separation and local bonding);
- extra low voltage power supply.

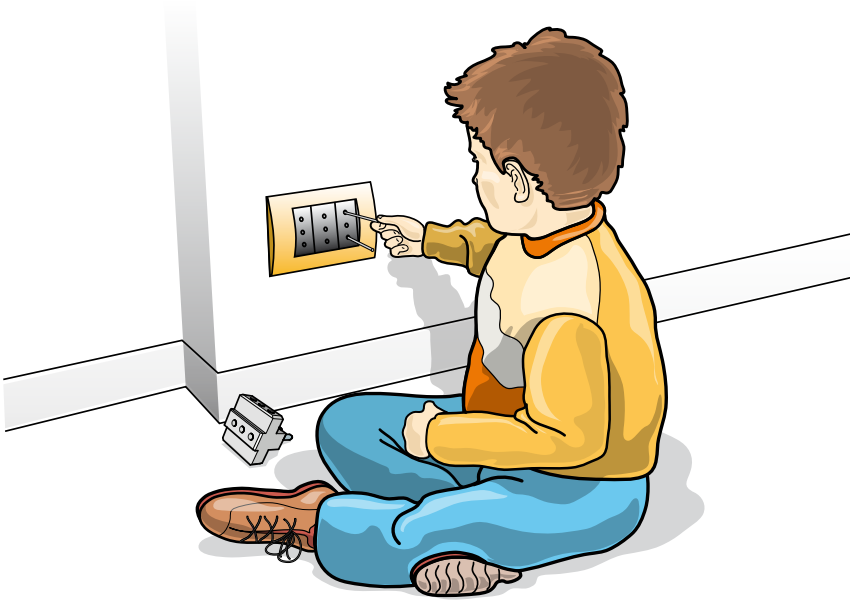
Additional protection

An additional measure of protection against the hazards of direct contact is provided by the use of Residual Current Operating Device, which operate at 30 mA or less, and are referred to as RCDs of high sensitivity.

According to IEC 60364-4-41, additional protection by means of high sensitivity RCDs ($I\Delta n \leq 30$ mA) must be provided for circuits supplying socket-outlets with a rated current ≤ 20 A in all locations and for circuits supplying mobile equipment with a rated current ≤ 32 A for use outdoors.

This additional protection is required in certain countries for circuits supplying socket-outlets rated up to 32 A and even higher if the location is wet and/or temporary (such as work sites for instance).

RCDs of high sensitivity ($I\Delta n = 30$mA) provide both protection against indirect contact hazards and the additional protection against the dangers of direct contact. It guarantees a complete protection!



Main type of RCDs

DIN rail RCDs are installed in the consumer unit and can provide protection to individual or groups of circuits.

DIN rail RCDs are mechanical switching devices designed to make, carry and break currents under normal service conditions and to cause the opening of the contacts when the residual current attains a given value under specified conditions.

RDC type	Description	Standards	Indirect contact protection	Additional protection	Overcurrent protection	Short circuit protection	Related ABB products
RCCB	Residual Current Operated Circuit Breaker without integral overcurrent protection	IEC 61008-1	■	■[1]	–	–	F200 series
RCBO	Residual Current Operated Circuit Breaker with integral overcurrent protection	IEC 61009-1	■	■[1]	■	■	DS200 series

[1] only for 10 and 30mA sensitivity

Types of RCDs normally used in residential applications

– RCCBs: Residual Current Operated Circuit-Breaker without Integral Overcurrent Protection which are compliant to IEC 61008-1. It is not designed to give protection against overloads and/or short-circuits and must always be used in conjunction with an overcurrent protective device such as a fuse or circuit-breaker.

– RCBOs: Residual Current Operated Circuit-Breaker with Integral Overcurrent Protection which are compliant to IEC 61009-1. It is designed to give protection against overloads and/or short-circuits and can be used independently of any other overcurrent protective device within its rated short-circuit capacity.

RCDs assure a protection to people and installations against fault current to earth.

ABB offer
RCCBs: F200 series

F200 series are RCCBs, which are sensitive only to earth fault current. Therefore they have to be connected in series with a MCB or a fuse to protect them against overcurrents and short-circuits.

They offer protection from indirect contacts and thanks to the availability of sensitivity of 10 and 30 mA they ensure additional protection against direct contacts.

RCCBs	
Family name	F200
Standard	IEC/EN 61008-1
Number of poles	2P, 4P
Rated current [A]	16, 25, 40, 63, 80, 100, 125
Sensitivity [mA]	10, 30, 100, 300, 500, 1000
Type	A, AC, B, APR* (A), Selective (A, AC, B)

* APR = RCCBs resistant to unwanted tripping

Test button

Indication of:
– Name of product family
– Type
– Rated current
– Rated sensitivity
– Device's rated voltage
– Short circuit coordination performance

CPI: Contact Position Indicator

Wiring diagrams to prevent from a wrong connection

ABB identity number for a quickly identification of the product

ABB offer
RCBOs: DS200 series

DS200 series are RCBOs, which combines in a single device protection against both earth-fault currents and overloads or short-circuits.

To meet the demand for devices capable of realizing complete protection of circuits modern plants, ABB expands the offering of its System pro *M* compact® with new Residual Current Circuit-Breakers with Overcurrent Protection, both available in two modules DS201 (1 phase + neutral) and DS202C (2 phases).

RCBOs		
Family name	DS201	DS202C
Standard	IEC/ EN 61009-1	IEC/ EN 61009-1
Number of poles	1P+N	2P
Rated current [A]	1…40	6…32
Sensitivity [mA]	10…1000	10…300
Type	A, AC, APR*	A, APR*
Breaking capacity Icn [kA]	4,5 (DS201L), 6 (DS201), 10 (DS201M)	6 (DS202C), 10 (DS202C M)

* APR = RCCBs resistant to unwanted tripping

Indication of:
– Name of product family
– Characteristic
– Rated current
– Rated sensitivity
– Type
– Device's rated voltage
– ABB identity number for a quickly identification of the product

CPI: Contact Position Indicator

Earth fault current indicator

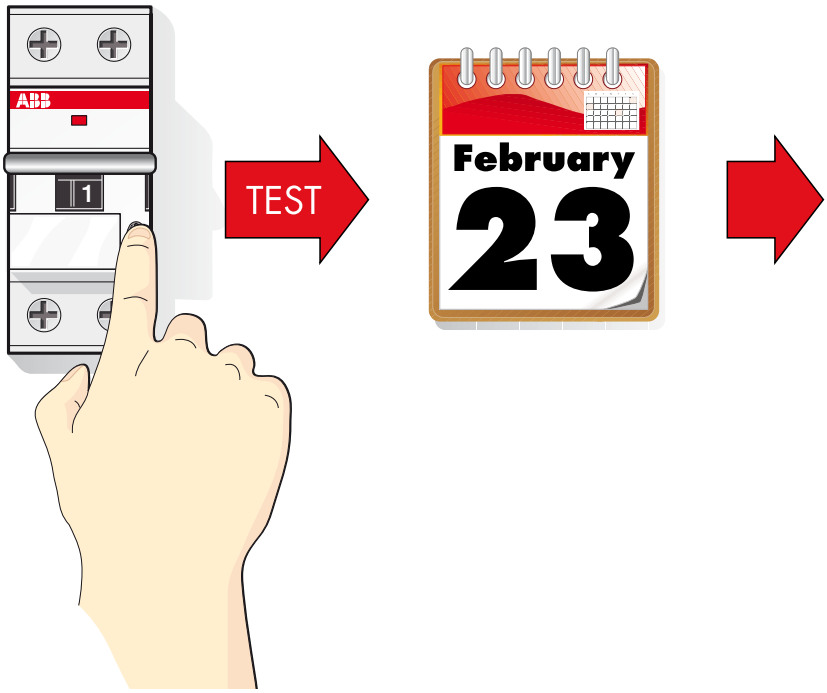
Wiring diagrams to prevent from a wrong connection

Label carrier

Test button

Use and maintenance of RCDs

If you have an RCD, you should check that it is functioning correctly by pushing the test button periodically to be sure that this protective device is properly working.



When tested, the RCD should switch off the power to the areas of the home it protects.
The RCDs in your consumer unit may not cover everything in your home, such as the lighting circuits, so it is a good idea to check - while the RCD is off - which sockets and lights are no longer working, showing that they are protected by that RCD (loads that remain supplied are not protected by the RCDs you are testing).
Switch the RCD back on to restore the supply.
If your RCD does not switch off the electricity supply when the test button is pressed, or if it does not reset, get advice to an electrician to check your installation.

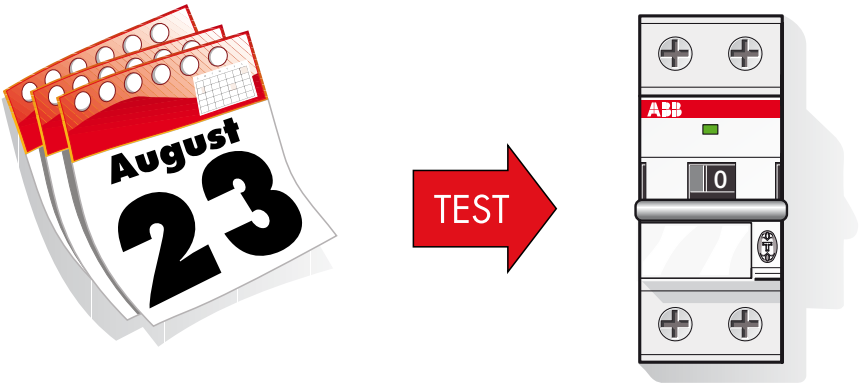


ABB leading technology of RCDs

ABB is a leader in power and automation technologies that enable utility and industry customers to improve performance while lowering environmental impact.

The ABB Group of companies operates in around 100 countries and employs about 145.000 people. Technology leadership, global presence, application knowledge and local expertise are key factors in order to offer products, systems and services that enable, ABB's customers, to improve their business in terms of energy efficiency, reliability of networks and industrial productivity.

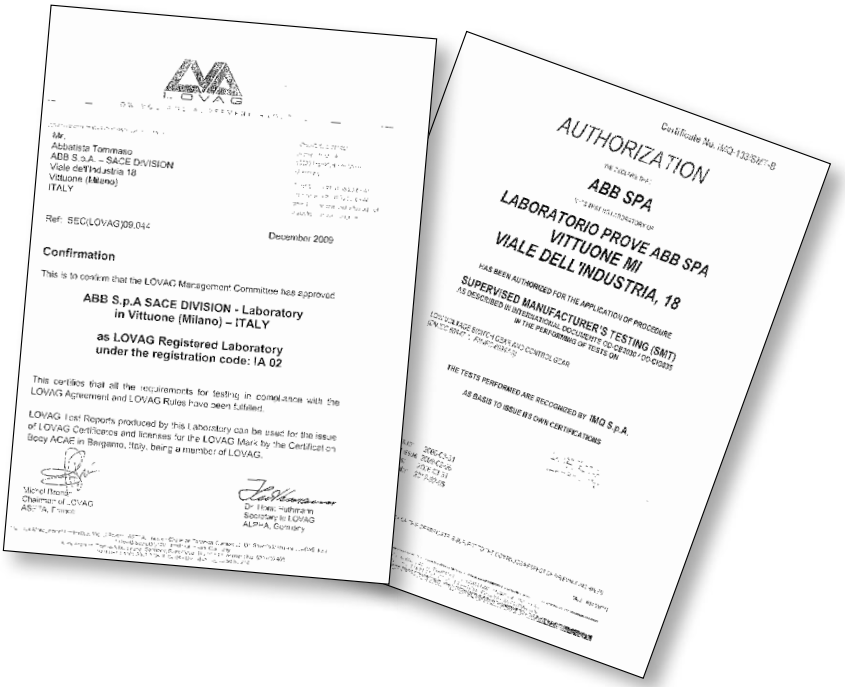
ABB Low Voltage Division: many solutions in low-voltage system

ABB Low Voltage Division offers a wide range of products and systems for low voltage electrical distribution and automation in the residential, commercial and industrial. The offering also includes intelligent building control systems, also known as KNX systems, for home and building automation to improve comfort, energy efficiency and security. Complete the portfolio components and systems for charging electric vehicles.
A significant part of these products are made in Italy, in highly specialized and automated production facilities, all sites have obtained quality certificates ISO 9001, Health and Safety OHSAS 18001 and ISO 14001.

Furthermore, ABB Low Voltage Division, being always focused on its peculiar excellence, has implemented in some of its factories IRIS and SA8000 certifications: this is the standard of absolute importance to quality and corporate social responsibility.
The local research and development, careful to the most important aspects of technological innovation, respond quickly and often anticipate the needs of designers, system integrators and installers operating in different sectors.

The laboratory tests ABB, thanks to a high-tech equipment and the expertise of its specialists, ensure accurate testing and a qualified certification of its products.

A testimony to the high standards achieved: the laboratory Low Voltage Division in Vittuone (Milan, in Italy) was accredited and recognized as ACAE LOVAG Registered Laboratory and was also authorized to apply the procedure Supervised Manufacturer's Testing (SMT).


Mr.
Abbatista Tommaso
ABB S.p.A. – SACE DIVISION
Viale dell'Industria 18
Vittuone (Milano)
ITALY

Ref: SEC(LOVAG)09.044

December 2009

Confirmation

This is to confirm that the LOVAG Management Committee has approved

ABB S.p.A SACE DIVISION - Laboratory
in Vittuone (Milano) – ITALY

as LOVAG Registered Laboratory
under the registration code: IA 02

This certifies that all the requirements for testing in compliance with the LOVAG Agreement and LOVAG Rules have been fulfilled.

LOVAG Test Reports produced by this Laboratory can be used for the issue of LOVAG Certificates and licenses for the LOVAG Mark by the Certification Body ACAE in Bergamo, Italy, being a member of LOVAG.

Michel Perrin
Chairman of LOVAG
AFNOR, France

Dr. Peter Huthmann
Secretary to LOVAG
ALPHA, Germany

AUTHORIZATION

Certificate No. IMQ-103SMT-B

ABB SPA

LABORATORIO PROVE ABB SPA
VITTUONE MI
VIALE DELL'INDUSTRIA, 18

HAS BEEN AUTHORIZED FOR THE APPLICATION OF PROCEDURE

SUPERVISED MANUFACTURER'S TESTING (SMT)

AS DESCRIBED IN INTERNATIONAL DOCUMENT CD CB32B / CD CI32B5
W THE PERFORMING OF TESTS ON

THE TESTS PERFORMED ARE RECOGNIZED BY IMQ S.p.A.

AS BASIS TO ISSUE ITS OWN CERTIFICATIONS

Contact us

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