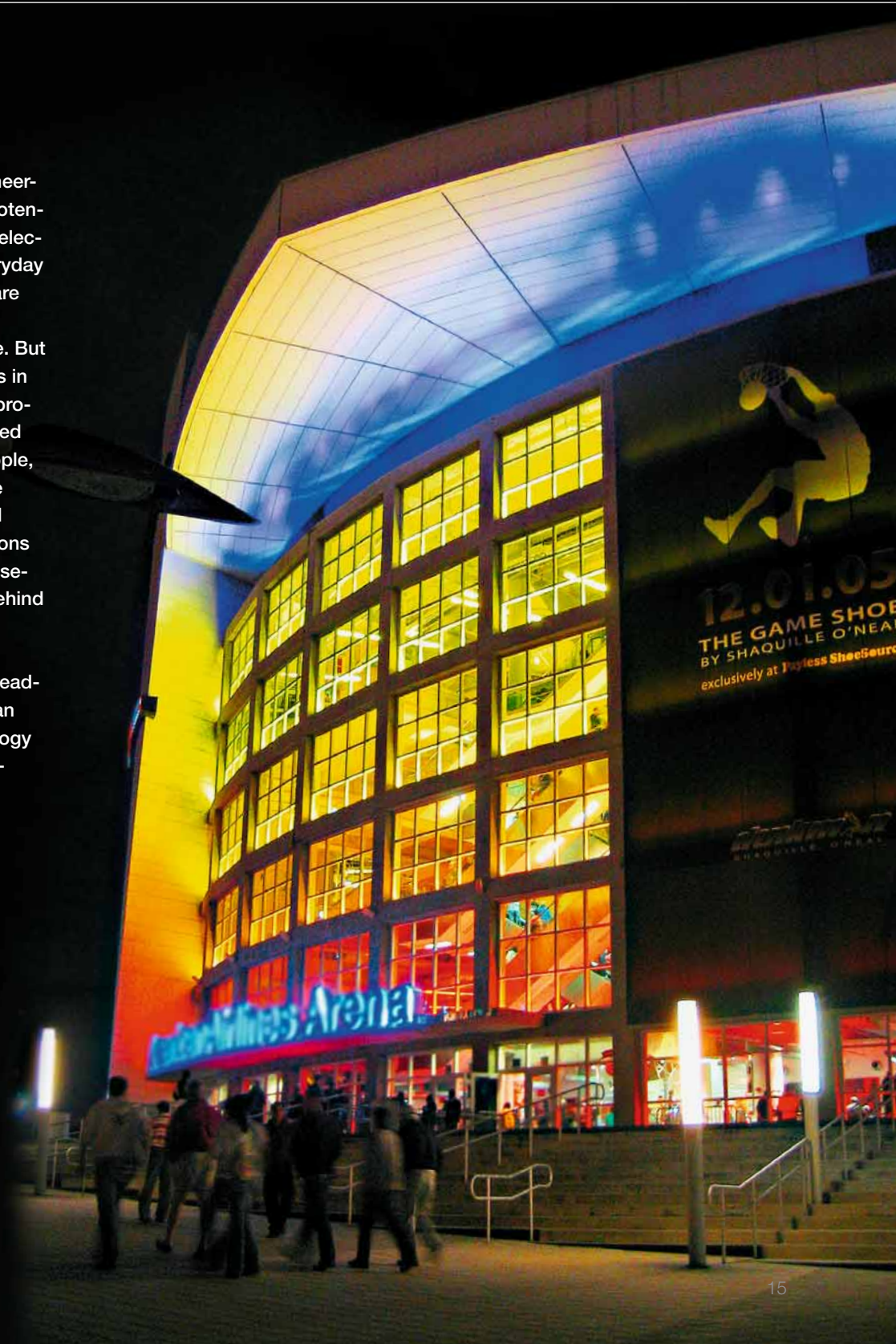
Invisible safety

Electrical installations in buildings

Guenter Schreiner, Gary Scardifield

One of the masterpieces of engineering is the transformation of the potentially dangerous quantity we call electricity into a completely safe everyday commodity. Most people are aware that touching a live wire carrying 220 V can be a painful experience. But despite the ubiquity of such wires in their homes, a very high level of protection is provided. A sophisticated system ensures the safety of people, of the installation itself and of the entire building. The elegance and the significance of such installations are commonly hidden away in basements and broom closets, and behind plaster.

This article attempts to give the reader a peek behind the scenes for an impression of the hidden technology that contributes to everyday well-being.



From time to time most people have had to go to the basement in order to fix a fuse, probably unaware of the purpose of all the various elements of the fuse and metering panels. There is a broad range of different building blocks that can be installed in a house. ABB, as one of the leading producers of devices and components for domestic and commercial applications, offers nearly all necessary units 1.

Prevention of excessive currents

One of the most important and widely used units in the field of home and building protection is the miniature circuit breaker (MCB) 2. MCBs are used for so-called line and fire protection, ie, they protect buildings and appliances from the effects of short circuits and overloads.

For example, if the insulation of a cable is damaged and two copper lines touch, a short circuit is generated. This leads to a high current, which forces an MCB positioned further upstream to release immediately. The short-circuit protection is based on an electromagnetic trigger that opens the circuit and interrupts the current flow.

An MCB is also responsible for the protection of the connected lines themselves: The unit must be designed for the expected load of all connected devices. If there are too many devices or if they have too high a consumption, a permanent overload can ensue. Such an overload may be insufficient to qualify as a short circuit, but can nevertheless cause the line to heat up, possibly resulting in a fire. Overloads of longer duration are detected by a thermal element inside the MCB that opens the circuit to prevent damage.

A broad and distributed use of MCBs increases what is called selectivity of protection. If a washing machine, for example, is protected by an individual MCB, a malfunction of the machine will lead to its disconnection. The supply of other devices, however, will remain unaffected, permitting them to continue operating. The more MCBs are installed for individual applications, the smaller the effects of any individual incident.

ABB offers a wide range of products that contribute to the comfort, security, reliability and energy efficiency of customers' electrical installations.

Another advantage of MCBs is their reusability. Traditional fuses must be replaced after each operation, which not only means that every household must keep a stock of spare fuses, but also introduces a certain risk of the incorrect types being used. MCBs don't have to be removed or replaced: A layperson can easily close the affected circuit by operating the toggle of the released MCB (of course after having addressed the problem, eg, by unplugging the defective appliance).

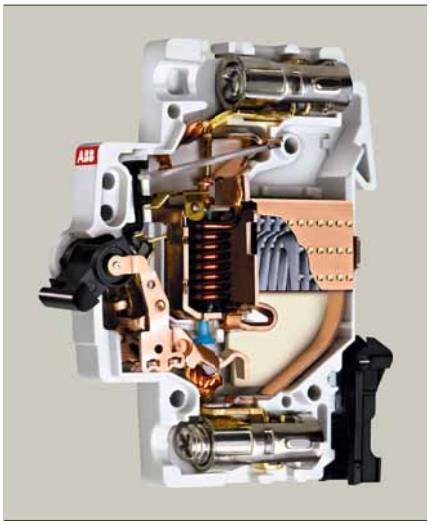
Well protected

Residual current devices (RCDs) represent another indispensable type of protection device. In accordance with international and national standards in all EU countries, all socket outlets and mobile equipment for outdoors must be protected by RCDs. RCDs detect leakage currents, which leave an electrical line and drain to the ground even if the current is very small. Like an MCB, it also has a detection mechanism for currents. When the leakage current rises above a certain threshold, the RCD immediately interrupts the current.

RCDs generally provide three kinds of protection:

- Basic protection. Normally this protects people from electric shocks. It can be the insulation of a cable or the housing of an electrically operated device or piece of equipment. If the basic protection is defective and someone touches the faulty part or if people deal carelessly with electricity, the RCD trips and interrupts the concerned circuit. In this case the RCD provides additional protection against electric shocks.
- Fault protection. This protects the user if a high voltage occurs on the housing of the device. The RCD will switch off the concerned electrical circuit, preventing a person from touching the faulty device.
- Preventative fire protection. This is needed if leakage current of an electrical line drains to the ground for some time. In this instance, an MCB would not switch off because the current is too low, even though this fault current might cause a fire.

2 Internal mechanism of the miniature circuit breaker (MCB)



1 The full range of installation devices supplied by ABB

Instead, the RCD switches of the concerned circuit.

The importance of selectivity applies here as well. A single RCD should not protect all sockets or all light circuits in a building, as all lights would go out in the event of a failure.

Preventing damage by voltage peaks

High currents are not the only source of risk in electrical installations. Another source of danger lies in overvoltages: While the nominal socket voltage is 220 V or 110 V, sudden peaks of much higher voltages (but of very short duration) may occur. They can be caused by lightning, switching operations or enormous load changes in the grid. Such occurrences can lead to the breakdown of insulation or cause damage to connected devices.

In fact, for electronic devices in common commercial and residential usage, overvoltages are the main cause of damage. Consequences of overvoltage damage can range from malfunctions through loss of data to fire. Computers, printers, monitors, DVD players or TVs (to mention a few) are affected by these malfunctions and their number is continuously increasing.

ABB's overvoltage protection devices limit voltage levels and switch voltage peaks to ground.

A whole range of devices for comfort

Besides these special protection devices, ABB offers a wide range of additional products that contribute to the comfort, security, reliability and energy efficiency of customers' electrical installations. These include:

Time switches

Selected sockets can be switched on or off automatically at definite times that are set by the customer.

Time relays

Different time functions can be realized, eg, automatic interruptions, delayed starts or cutoffs.

The safe, reliable and efficient infrastructure that is provided by domestic electrical installations is controlled by regional regulatory bodies all over the world.

Twilight switches

Lights can automatically switch on or off in response to a selected level of ambient light.

Load-control relays

For various reasons, the simultaneous operation of two powerful loads (eg, storage heating and ventilation heaters) may be impossible. In such situations, a relay switches off the device whose operation is long-term (storage heating) when the short-term device (ventilation heater) is used.

Energy consumption meters

These meters allow the separate measurement of the energy consumption of individual devices or parts of the building, for example an apartment in a residential building. They offer an easy overview on energy consumption and can contribute to a more efficient use of electrical energy.

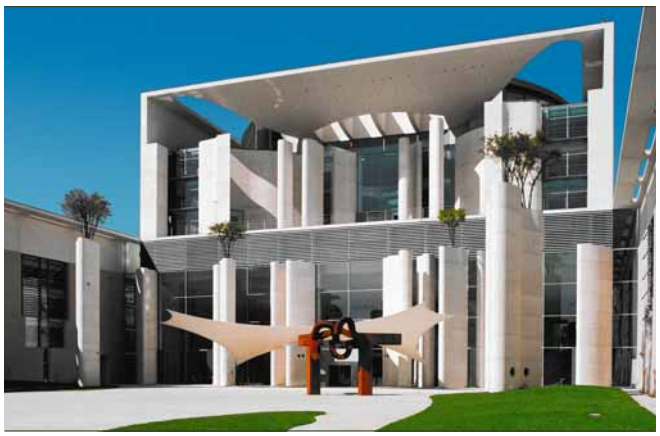
Worldwide approval

The safe, reliable and efficient infrastructure that is provided by domestic electrical installations is controlled by regional regulatory bodies all over the world. Before any of these devices can be released onto the market and installed in people's homes, they must gain approval from the respective authority.

ABB products, used by customers in almost all countries around the world, have obtained this approval and provide the highest level of protection for the individual user 3. But it is not only the end user who benefits from this approval and standardization – the in-

3 ABB's domestic installation devices fulfill a broad range of certifications from all over the world.

4 The Bundeskanzleramt in Berlin



5 Electrical installation securely placed in safe cabinets

staller who fits the electrical installation into the building also benefits. The standardized installation technique using rail-mounted devices offers a high level of efficiency and robustness for the installation work.

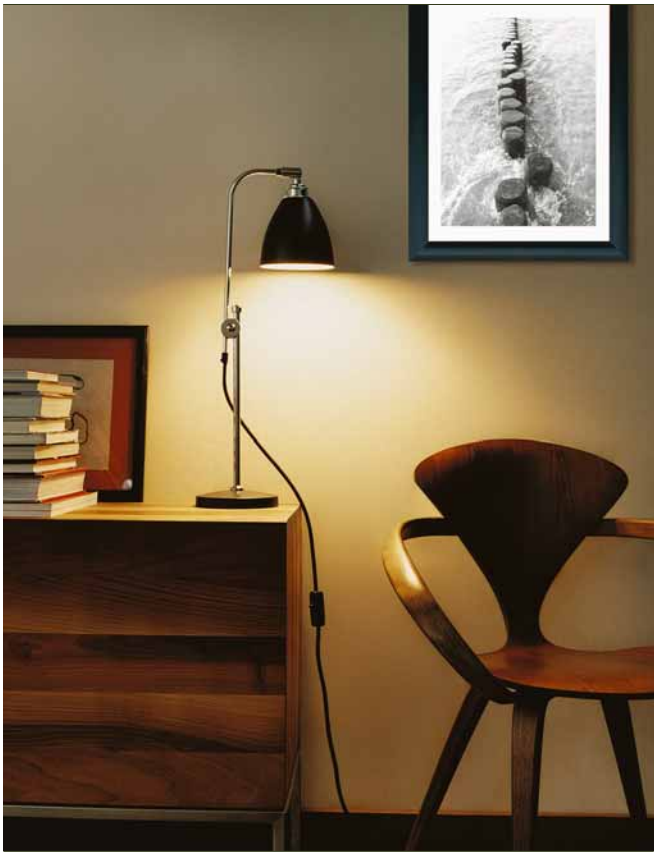
Safety without compromise

All the protection and metering units mentioned above have to be installed in the building in such a way that even inexperienced or inattentive people are not endangered when they come into contact with the installation. This is ensured by fixing the units to rails in a safe and standardized way, and in addition, by mounting these rails in immovable and closed cabinets.

Depending on the requirements of the building that has to be supplied with electrical energy, these cabinets can reach a respectable size. 4 shows the building in Berlin in which the German chancellor is based – the Bundeskanzleramt. To ensure a reliable electrical infrastructure, ABB has supplied the installation placed in the basement of the building 5.

The type-tested low-voltage switchgear assemblies (TTA), rated for up to 4,000 A, guarantee the very highest standards in terms of personal and plant safety, as well as of availability of the energy supply in a commercial and industrial environment. A unique advantage for the end user is the wide range of type-tested enclosures available, from 125 A for a small subdistribution board up to 4,000 A for a main distribution in a TriLine-R switchgear cabinet. Combinations of enclosure and devices are put through their paces when type-tested to ensure reliability and safety for the user. Such testing is documented by certified and independent approval bodies. This not only ensures that installations are fit for their purpose but also guarantees end users that their electrical installation is correctly dimensioned. ABB equipment is successfully operated in such demanding environments as hospitals, sports arenas, shopping malls, banks or office buildings.

6 The front cover of a cabinet looks like a picture, permitting decorative placement in a house.



When it comes to safe installation in residential buildings, additional aspects are appreciated by customers: These include the attractive appearance of cabinets if they are to be mounted in the living area of the house.

The best technologies are often those that remain unseen because they behave exactly as the user intuitively expects, all the time and every time.

The ABB UK 500 series consumer units fulfill these additional customer wishes. The units are marked by a harmonious interplay of design, advanced technology and high-grade assembly to the highest quality. The UK 500 consumer units can be supplied for flush or surface mounting. They can also be mounted in hollow walls, or partially recessed. With the addition of attractive door options in an interesting design, a technical product is created that meets the demands of décor and layout, not only blending ideally into its surroundings but also acting as an eye-catching focal point 6. The wide range of modular wall-mounted, floor-standing, and switchgear cabinets enables each customer to select an individual and economical configuration.

Comfortable safety

The best technologies are often those that remain unseen because they behave exactly as the user intuitively expects, all the time and every time. ABB technology does precisely this. Whether people are watching a football match under floodlights, or shopping in a brightly-lit mall in an air-conditioned atmosphere, ABB technology is providing safe and reliable electrical operation of building and residential infrastructure.

Guenter Schreiner
ABB STOTZ KONTAKT GmbH
Heidelberg, Germany
guenter.schreiner@de.abb.com

Gary Scardifield
ABB Stiebel & John GmbH
Sasbach, Germany
gary.scardifield@de.abb.com