The Smart Guide



Overview	03
Working from Home	06
Types of Faults / Invisible Dangers	13
Useful Safety Checklist	28
Essential Safety Products	36
Smart Homes Technology and Safety	40
A Holistic Approach to Electrical Protection in	
Construction	44
Conclusion	48



Overview



Universal changes have shifted how we view our homes. They are not only dwellings for sleeping and relaxing but are now also offices, school rooms, and more. While sustainability always remains at the forefront of our smart technologies, comfort and mitigating the environmental impact are also driving factors behind our actions. No matter how our homes are constructed and designed, safety always matters, especially in households where end-users do not have the related expertise.

The residential sector represents a large percentage of the world's electricity consumption - 29%¹. With the development of electric vehicles (EVs), the widespread use of heat pumps and air-conditioning for residential ventilation, and the increase in extreme weather around the world causing mass blackouts, it's clear this demand is only expected to increase. On-site solar generating, energy storage, abd demand response programes are some new strategies to lessen the CO² impact. With sustainability becoming top-of-mind criteria to mitigate global warming, energy supply and demand in the home need to be managed accordingly, for cost as well as safety concerns.

This increase in consumption may possibly create more risk. The need for resilience has become more apparent in many regions of the world due to the rise in electrical outages, such as the Middle East, Australia, the USA, and beyond. According to the US Department of Energy research, weather-related power interruptions are the main reason for blackouts. Wildfires and other catastrophic disasters sometimes force utilities to turn off the power for public safety purposefully². Countries such as Iran and Iraq have been experiencing extreme heat of above 122 degrees Farenheit, which coupled with poor electricity infrastructure, is causing severe power outages³.

In certain places, utilities use deliberate brownouts to prevent rolling blackouts; in other sites, mandatory energy usage cutbacks are implemented to help the area's overall energy infrastructure fulfil its needs. These occurrences are enhancing interest in and demand for onsite generation while elevating resilience to a top priority.

Schneider Electric is committed to driving innovation and accelerating sustainability, with a purpose firmly rooted in these values. We are constantly working with home builders, electricians and even designers towards providing the best digital technologies for our ever-changing world.



Residential sector represents 29% of the world's electricity consumption



Weather-related power interruptions causing blackouts



Countries have been experiencing extreme heat of above 122 degrees Fahrenheit

Working from Home

ANUS

More people moved to working from home to protect the community during the pandemic. Due to the stay-at-home orders, people were spending more time in their living room, kitchens, and home offices. Many still are working from home or partaking in hybrid working situations. And more people spending more time at home presents potential electrical hazards.

According to the IEA, approximately one-third of the world's population was in complete lockdown in April 2020, and houses were converted into offices for employees and classrooms for students. This situation compelled approximately 59% of employees to work from home, altering the pre-pandemic energy consumption pattern in residential buildings⁴.



Prior to 2020, residential electricity consumption was high in the mornings and decreased throughout the day, with peaks in the evening. During the pandemic, electricity demand increased later in the morning. It remained constant at a 16% increase during working hours, resulting in an overall increase in electricity consumption ⁵, by running systems such as air conditioners, lighting, and appliances during work hours. For example, average energy usage for the heating, ventilation and air conditioning (HVAC) unit increased by 25% in the month of April 2020 compared to the same month for the years 2017-2019 ⁶.



India experienced heatwaves and the country's biggestever peak in power consumption as a result of March 2022 being the warmest month on record.

While the world has now returned to a form of normality, there are lasting effects in the way we live and consume energy. Home delivery has become the norm, the way entertainment is distributed has altered, and many people work under hybrid models. Shifts such as these are affecting the rise in demand for energy. In 2022, the global electricity demand rose 3%, in line with the historic average⁷. These changes in how we live, work and play are not only driving energy demands, but also can potentially lead to a high risk of electrical dangers around the home. At the same time, extreme weather events across the world not only draw obvious concerns about rising bills and energy issues but also implicitly expose potential safety risk, which highlight the need for increased security of supply and resilience.



More focus is needed on electrical security in a world where both supply and demand for electricity are becoming more weather-dependent. Extreme weather events posed difficulties for the world's power systems in 2022, in addition to the high cost of electricity generation. Along with the drought in Europe, India experienced heatwaves and the country's biggest-ever peak in power consumption as a result of March being the warmest month on record. Delhi also registered its highest-ever temperature in May 2022 of 49°C⁸. Extreme heat across the Middle East spiked the demand for energy, which means widespread power outages have been affecting millions. ⁹In December 2022, there were numerous significant power disruptions in the United States due to strong winter storms.

Power systems need to become more flexible in order to maintain a secure and reliable supply of electricity. Ensuring the resilience of these systems will be crucial. Alongside this, households need to be educated in electrical safety to ensure they are safe or use energy efficiently.

Essential safety measures for every household

Households are often aware of certain safety measure that can keep their families and belongings safe, but they don't necessarily know how to put them into practice. Here are outlined specific tips based on the biggest concerns, for householders to know and for electricians to share with their clients when working in homes.

Overloading outlets

An overloaded outlet draws more power than the circuit can support. Never connect more than the specific load. A scenario that poses a hazard to life can arise from an overload.

Tripping hazards

A cord that is close to a doorway or crosses a walkway could be a tripping hazard. Serious bruising, fractured bones and injuries to the head, brain, and the spine can arise from slipping, tripping, or falling.

Appliances not in use

Electricity can be saved by unplugging appliances while they are not in use. Moreover, it lessens the possibility of electric shocks or explosions. All electronics, including computers, televisions, modems, gaming devices, mobile chargers and home cinemas, should be unplugged.

Cords under carpets, rugs, doors, or windows

A door or window sash can damage an electrical cable, creating a safety issue, and a carpeted cord can quickly overheat. Also, never run a cord across or under a beam, or beneath heavy furniture.

Using extension cords

Never rely on extension cords as a permanent fix. They are susceptible to damage from continuous use. Turn them off when connected devices are not in use.

Distance between combustibles and heat sources

Keep paper, wood, household chemicals, and other combustible items (or anything that can generate compustible vapours) at least three feet away from heat sources to reduce the risk of fire.

Power strip or extension cord to link fans or space heaters

Fans and heaters should be plugged directly into a wall socket. Otherwise, the quantity of energy produced could cause the power strip or cord to overheat, short circuit, or catch fire.

The wattage of your lights

Considerations such as brightness, temperature, and colour rendering index are crucial, so make sure to double-check the wattage to make sure the light is safe and won't cause an electrical overload.



Cord damage

Tears in insulation and exposed wires can cause sparks, explosions, shocks, and electrocution. Using an appliance in this situation can be very dangerous. The broken cable should be replaced as soon as feasible.

Smoke detectors

You should check your smoke detectors at least once a month. Pressing and holding the test button for a few seconds will trigger the loud siren. This shows that the gadget is functional. If the alarm is broken or doesn't function, swap either the batteries or the smoke detector.

Additional tips to keep in mind while working from home



Electrical devices shouldn't be charged on beds. Always charge on a hard, flat surface that is not combustible. To make sure that sockets and extension leads are not overburdened, use our online socket calculator.

Keep a spotless workplace. It's crucial to keep hot and cold beverages away from electrical gadgets to avoid spillages that can damage gadgets and appliances, and even cause fires.





Extension leads should not be connected in a "daisy chain" arrangement. Don't use another adaptor if a cable isn't long enough. Using a longer lead or relocating your desk closer to the socket are two options.

Have your electrician's phone number handy in case you need to contact them quickly. They will be the most skilled person to help with any electrical issues.



Types of Faults / Invisible Dangers

Homes are riddled with potential electrical hazards, both easily recognisable and invisible. Most electrical faults are considered to be invisible dangers and should only be handled by a professional electrician.



Overview

While they are in use, electrical networks, machines, and equipment are frequently prone to several kinds of defects. When a defect arises, the machine's characteristic values (such as impedance) may shift from their current values to different values until the issue is fixed.

There are several potential causes of problems in the power system network, such as lightning, wind, trees falling on power lines, equipment failure, etc. While these external factors are often able to indicate a problem that needs to be fixed, some issues are harder to see before it's too late.

An arc flash is a potentially lethal explosion of energy from an electrical circuit, or a type of discharge caused by a low-impedance connection through the air to the ground or to another voltage phase in an electrical system.

Arc flashes are all too common, and many of these incidents result in injuries, and some are even deadly. Creating a heat blast of up to 35,000 degrees Farenheit, arc flash incidents can also damage equipment and interrupt business operations, leading to significant economic losses.





Develop and audit electrical safe work practices policy.



Conduct an arc flash risk assessment to evaluate the likelihood of occurrence and severity of arc flash hazards.



Follow strategies to mitigate and control arc flash hazards.



Conduct regularly scheduled safety training and audits for all electrical workers.



Maintain electrical distribution system components.



Ensure adequate supply of personal protective equipment (PPE) and proper tools that act as the "last line of defence" for exposed workers.

Electrical faults in power systems



Electrical faults

Any abnormal situation of the system involving the electrical breakdown of the apparatus, sockets, wires and cables, etc., is referred to as a fault in an electrical power system. Short circuits and open circuits of conductors are caused by insulation failures and problems with the conducting channel, respectively. The electrical equipment in a power system network operates at normal voltage and current ratings when it is safe to do so. Voltage and current values depart from their nominal ranges if a fault in a cirvuit or device occurs. Over- current, under-voltage, phase imbalance, reversed power, and high-voltage surges are all caused by power system problems. This causes the network's regulr operation to be interrupted, as well as equipment failure, electrical fires, etc.

To reduce the loss of service caused by electrical failures, power system networks are often safeguarded using switchgear protection instruments such as circuit breakers and relays.

In a three-phase power system, there are primarily two types of electrical defects: open and short circuit faults. These defects can either be symmetrical or asymmetrical. Let's go over these flaws in more depth.

Open circuit faults

One or more conductors failing is the cause of these issues. Joint failures of cables and overhead lines, failure of one or more phases of circuit breakers, and melting of a fuse or conductor in one or more phases are the most frequent causes of these defects. Series faults are another name for open circuit faults. Except for the three-phase open fault, these faults are asymmetrical or unbalanced.



Open circuit faults

- Think about a transmission line that is operating with a balanced load prior to an open circuit fault. If one of the phases melts, the alternator's actual load is reduced, which raises its acceleration and causes it to run at a speed that is just a little bit higher than synchronous speed. Overvoltage in other transmission lines is brought on by this excessive speed.
- Hence, single and two-phase open circumstances can result in an imbalance of the voltages and currents in the power system, greatly damaging the equipment.
- A broken conductor and malfunctioning circuit breaker can cause issues in one or more phases of an electrical circuit.

Effects

- Abnormal operation of the system.
- Danger to personnel as well as animals.
- Exceeding the voltages beyond normal values in certain parts of the network, which further leads to insulation failures and developing of short circuit faults.
- Although open circuit faults can be tolerated for longer periods than short circuit faults, these must be removed as early as possible to reduce the greater damage.

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Short circuit faults

A short circuit is described as an anomalous connection of a very low impendance between two locations of different potential, whether purposeful or unintentional.

They are the most frequent and dangerous failures, causing abnormally large currents to flow through machinery or transmission lines. When these defects are ignored, even for a brief time, the equipment suffers significant hazards.

Shunt faults are another name for short circuit faults. These problems are brought on by a breakdown in the insulation between the phase conductors, the ground, or both.

Three-phase
short circuitPhase-to-phase short circuit
clear of earth \downarrow \downarrow </tr

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As seen in the image, there are several different short circuit fault circumstances that could occur, including three phases to earth, three phases clear of the earth, phase to phase, single phase to earth, two phases to earth, and phase to phase plus single phase to earth.

Whereas the remaining faults are unsymmetrical faults, the three-phase faults clear of earth and to earth are balanced or symmetrical short circuit faults.

Short circuit faults

Effects

These may be due to internal or external effects:	Arcing faults can lead to fire
Internal impacts include transmission line or equipment failure, corrosion of insulation in transformers, generators, and other electrical equipment, faulty installation, and poor design. External effects include overloading of equipment, insulation failure due to lighting surges, and mechanical damage by the public.	 and explosion in equipment such as transformers and circuit breakers. Abnormal currents cause the equipment to get overheated, which further leads to a reduction of the life span of their insulation. The operating voltages of the system can go below or above their acceptance values which creates a harmful effect on the service rendered by the power system. The power flow is severely restricted or even completely blocked as long as the short circuit fault persists.



Symmetrical and unsymmetrical faults

As discussed above, faults are mainly classified into open and short circuit faults and again, these can be symmetrical or unsymmetrical faults.

Symmetrical faults

- A symmetrical fault generates currents that are dispersed by 120 degrees from one another. A balanced fault is another name for a symmetrical fault. When all three phases are concurrently shorted out, this fault occurs.
- Compared to unsymmetrical flaws, these faults are less common in practice. Line to line to line (L-L-L) and line to line to line to ground (L-L-L-G) are two examples of symmetrical faults.
- A rough estimate of the proportion of symmetrical faults in the total number of system defects is between 2 and 5%. Unfortunately, even if the system is still in balance, if these mistakes happen, they destroy the equipment.
- For determining the rupturing capability of the circuit breakers, choosing set-phase relays, and choosing other protective switchgear, an analysis of these faults is necessary. Bus impedance matrix analysis or Thevenin's theorem is used to examine these errors on a phase-by-phase basis.

Unsymmetrical faults

Unsymmetrical faults are the most frequent types of network problems in the power system. Unsymmetrical fault currents are produced by this type of fault (having different magnitudes with unequal phase displacement). These errors, which result in imbalanced currents in the system, are also known as unbalanced faults.

As per the explanation above, unsymmetrical faults consist of both single-phase and two-phase open circuit faults as well as short-circuit faults (excluding L-L-L-G and L-L-L).

The three symmetrical fault types caused by short circuit conditions—phase or line to ground (L-G) fault, phase to phase (L-L) fault, and double line to ground (L-L-G) fault—are depicted in the pictures below:





One of the most frequent defects is a single line-to-ground (LG) problem, which accounts for 70–80% of all faults in the electrical system. This creates a path for a short circuit between the line and the earth. When compared to other defects, these are much less serious.

When a live conductor comes into contact with another live conductor, a line-to-line fault occurs. This problem, which could be caused by overhead wires swinging into one another, is primarily caused by strong winds. These defects are less serious, and their frequency may range from 15% to 20%.

Two lines make contact with both the ground and each other in double line-to-ground faults. Compared to all system defects combined, the frequency of these severe faults is roughly 10%.

An unsymmetrical component analysis is used to examine symmetrical faults and determine the voltages and currents present throughout the entire system. In comparison to symmetrical faults, the study of these faults is more challenging.

To choose the right size circuit breaker for the maximum short circuit current, this study is required. L-G or L-L faults typically provide a higher current.

Protection devices against faults

When a failure develops in any section of the system, it must be fixed quickly to prevent further harm to workers and equipment as well as a disruption in the supply of electricity to the consumers.

Relays and circuit breakers are just a couple of the protection tools the fault-clearing system uses to find and fix faults.

The following list includes some of these fault-clearing or fault-limiting devices:



made up of a tiny copper wire that is encased in glass or another material that has two metallic connections. The wire melts because of the high fault current raising the wire's temperature. When a fuse blows, the wire needs to be manually replaced every time.



Circuit Breaker

Under normal working circumstances, it is the most prevalent protection device that can manually or remotely close or open the circuit.

Depending on the working voltage, a variety of circuit breakers are available, including air brake, oil, and vacuum,



Protective Relays

These devices that look for faults. To isolate the problematic circuit, relays the fault and start the circuit breaker's function. Contacts and a magnetic coil make up a relay (NC and NO). The contacts are activated as a result of the fault current energising the coil and creating the field. Some of the types of protective relays include:

- Magnitude relays
- Impedance relays
- Directional relays
- Pilot relays
- Differential relays



Lighting Arrestor

Power system network surges brought on by lightning strikes to equipment and transmission lines result in high voltage and currents. By installing lighting arrestors at transmission equipment, these lighting risks are minimised.

Hazards with electricity

The majority of individuals only consider the obvious risks associated with electricity, such as inadvertent shocks caused by a broken switch or equipment. What about the unnoticed risks, though? Using electricity carelessly can be dangerous. If you don't take measures, there is a very real possibility of accidents, fires, burns, and electrocution.

In general, homeowners, as end-users, do not have the professional know-how to make sure everything at home is safe and properly wired or installed. Electricians with the technical expertise and qualifications are those who can offer the right solution and advice to help keep households safe and lower their risk of getting hurt.

Here we examine some of electricity's hidden dangers and provide safety reminders that homeowners may expect from an electrician.

10 hidden hazards with electricity you may not have been paying attention to:





Turn off the electricity

Turning off the power is the first and most crucial step in preventing any further harm brought on by electricity. Make sure to cut off the power before working on electrical equipment, such as installing a new light or unplugging and replacing a malfunctioning device. Since electricity flows through every component of the system, you must ensure that the power is entirely shut off.

Many homes are equipped with a fuse box. The fuse that controls the circuit you're working on can be shut out, to turn off the power. Homeowners and households need to be aware of how to shut off the main circuit breaker in their electrical panel. They should be educated to call a licensed electrician right away if there is an electrical emergency. A non-professional should not try to fix it themselves because they can cause damage, worsen the condition, or even put themselves in danger.

Check home's wiring and outlets

To ensure a home's wiring is secure and in good working order it is important to have it inspected regularly. Homeowners should be reminded to have their home's wiring looked out as soon as possible if they live in a home that is more than a few years old or if they have observed that it is not in good shape. It is crucial for households to contact a licensed electrician to inspect the wiring in their home.

The wiring needs to be changed as soon as possible if it is damaged in any way. Likewise with outlets, which might cause shocks and fires if they are too loose. Not taking action on this can be dangerous, causing electric shocks or even starting a fire.

Keep cords and appliances in good condition

Conditions of cords and appliances are one of the most frequent causes of electricity-related accidents. Even if the electricity is off, worn or frayed cords are hazardous. A frayed or damaged cord may overheat and catch fire. Make sure homeowners know how to maintain the condition of cords and replace them when they become excessively worn.

Appliances follow the same rules. Appliances could start a fire, shock a person, or result in other injuries if they aren't functioning properly. It's simple to get electrocuted by buying inexpensive appliances and cutting corners.

Use a residual current circuit breaker (RCCB)

You can use RCCBs as tools to safeguard households from electrical fires and electrocution. A circuit breaker panel has these, and they guard against electric shock by cutting off the electricity if it goes into the ground.

To prevent shocks from defective wiring or appliances, these devices are advised for use in locations with water, such as kitchens, bathrooms, garages, and outdoor spaces.

Don't bend or coil wires

It is strictly forbidden in the world of electrical safety to bend or coil your wires. It overstresses the wires and causes them to fray, potentially leading to electrical fires. Ensure homeowners are aware that wires are attached without being bent or coiled, and they are kept away from moisture and other potential hazards. Furthermore, they should be kept a foot away from anything flammable.

Use quality wiring and equipment

The quality of wiring and equipment can affect how probable it is that they'll cause an electrical fire. Equipment that has received approval from local regulators or certification bodies is a sign of quality. The wiring in homes is to blame for a large number of the risks associated with electricity. Fires, electric shocks, and electrocution can all result from poor wiring. Poor wiring can include peeled-off wires, too many extension cords, hot outlets, or the wrong outlets in wet areas, among others. Having an electrician examine the wiring ensures safety as they are the people to engage with to replace any faulty wiring within a home.

Lock-in-place extension cords

Advise the use of lock-in-place extension cords. They have locking mechanism that prevents the plug from being taken out of the socket. By doing this, inadvertent shocks may be reduced. Moreover, be sure to advocate for the appropriate gauge extension cord for plugged-in gadgets.

Stay away from water when using electrical appliances

Although it ought to be obvious, this merits noting. Homeowners need to be educated about the risk of electrocution when using electrical devices such as toasters, in a moist environment. It is advisable to avoid using any electrical items near water.

Check cords and batteries

Homeowners should regularly inspect their wires and batteries to make sure they are in good working order. Broken wires and batteries provide a risk of fire or electric shock. They need to immediately replace the cords or batteries if they notice any cuts, nicks, or other damage. Once a year, they should also change the batteries in carbon monoxide and smoke detectors.

Keep flammable materials away from outlets

Another important tip is to keep anything flammable away from outlets, such as furniture, curtains, and rugs. This is unsafe and can lead to fires. Homeowners should also keep electrical appliances like computers and TVs away from combustible objects.



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Electrical safety in the home

Sometimes, a lack of education and understanding of what to know and look for can lead to damage and injury. Provide your clients with the following electrical safety tips in order to avoid potential dangers around their homes and properties.



Get a licensed electrician to do your wiring

It is of the utmost importance that all households know to call a licensed electrician if they need electrical wiring or repairs, no matter how minor the job.

Look after appliance cords

Keep electrical appliances, their cords, and any extension leads away from water. Ensure cords are in good condition – if they're worn or frayed, the appliance should not be used until it's been repaired by a licensed electrician.

If the appliance is thrown away, make sure it can't be used by someone else.

Only ever disconnect an appliance at the outlet by pulling the plug, not the cord. This extends the life of your appliance.

Avoid piggy-back or 'double adaptor' connections

Overloading can occur if too many cords are connected to outlets designed for only one or two plugs. Use power boards with in-built safety devices to avoid a power outlet overload.

Install safety switches

Have safety switches such as a Residual Current Circuit Breaker (RCCB) installed in the consumer unit. As a general rule, electrical equipment should only be used when connected to a safety switch.

Test safety switches

Testing every three months is a good rule of thumb. To do this, you just need to make sure the home's safety switch is working by either pressing it or flicking it off, depending on the type of safety switch in use.

If the switch turns off the power, then it's working correctly. Keep in mind, though, that using safety switches doesn't mean you can be less careful when using electricity – they are no substitute for proper electrical maintenance and safety practices.

Look out for overhead lines

Avoid coming into contact with overhead lines. If working near them, always keep a safe distance – at least 6.4 meters for wires on poles and 10 meters for wires on towers. Keep this in mind when installing antennas, picking fruit or pruning trees, and using a ladder or a metal tape measure.

Look out for underground power lines

Know the location of any underground power lines before digging at your property. Check with your local council or search for any national call lines you can use to check for the presence of underground power lines.

Look out for water leaks

Water is a good conductor of electricity. If water leaks into the light or power circuits in a home, a fault may occur, which could result in a fire or someone experiencing an electric shock. As soon as a water leak is detected, it should be repaired by a licensed plumber.

In the event of an electric shock

If you feel a tingle when you touch a water fitting, the grounding of the electrical installation could be faulty. If it's safe to do so, shut off the power at the main switch (usually found in the consumer unit) and call a licensed electrician to investigate.



If you go to help someone who's receiving an electric shock, turn off the power at the main switch first. If the current can't be turned off, use a non-conducting object, such as a broom, chair, rug, or rubber doormat, to push the person away from the source of the current.

If possible, stand on something dry that doesn't conduct electricity, such as a rubber mat or folded newspapers.

Call your local emergency services line for emergency assistance and stay with the person until help arrives.

Using electricity safely

Stay safe at home by ensuring all electrical appliances and equipment are in good working order.

The safe and efficient use of electricity in the home is important for your family's welfare and may assist you in reducing electricity usage and your costs. Keep your family safe by ensuring all electrical appliances and equipment in and around your home are safe to use and in good working order.

Safe use of electrical appliances and equipment



Follow these simple tips for keeping electrical appliances and equipment in good working order and making your home safe.

Service appliances in accordance with the manufacturer's instructions.	Avoid using old or damaged electrical appliances, including those with frayed cords, cracked or broken plugs, or those that have given someone a shock. Replace frayed or damaged cords immediately or dispose of the appliance. Consider replacing old plugs with modern ones that have safety barriers between connections.	
Buy safe electrical appliances that comply with local regulations/ certifications	Do not attempt to repair faulty electrical appliances yourself – only a qualified repair technician or a licensed electrician can repair appliances.	
Clean rangehood filters regularly.	Remove any build-up of materials around the electric motor of exhaust fans, such as fluff, dust, lint etc.	
Clean the lint filter in your clothes dryer after each use.	Do not touch or attempt to repair a loose, cracked or broken power point switch – cover it immediately and arrange for a licensed electrician to replace it. Avoid 'piggybacking' adaptors, instead use a power board with a built-in safety device.	
Clean ovens and cook tops regularly to prevent the build-up of spilled fats and burnt foods.	Do not spray household cleaners, detergents and insecticides on electrical accessories – they may cause cracking and create an electrical hazard.	

Keeping kids safe

Electrical injuries in children are sometimes caused by poking objects inside appliances, unused power points or playing with appliances.



- Switch off and unplug all electrical appliances when not in use.
- Don't permit children to touch or play with electrical cords and make sure electrical cords are not dangling from benches or within your child's reach.
- Use power boards with inbuilt safety switches when plugs are unavoidably within your child's reach.
- When they are old enough to understand, explain the dangers of electricity and teach them how to use your household electrical appliances safely.

Safety checklist: electricity and water

Water and electricity do not mix. It's important for home builders and homeowners to be aware of electricity around water.

Follow these simple tips to ensure the safe use of electrical appliances near water.

Never use any electrical appliance near water.	Immediately dispose of an electrical appliance that has been immersed in water.
Never touch anything electrical with wet hands or bare feet.	Do not use extension leads or power leads in wet areas – unless they are specifically designed for that purpose.
Never leave an electrical appliance where it can fall into the bath or basin.	Wear rubber or plastic soled shoes when using electrical appliances in laundries, on concrete floors or outdoors – many victims of serious and fatal electrical accidents are barefooted.
Never leave an electrical appliance unattended around children.	Electricity near swimming pools can be lethal.
Switch off and unplug all portable electric appliances, such as hairdryers, hair straighteners, shavers, etc. after use.	Electric shocks received in the vicinity of a swimming pool are more likely to be fatal than those received in other locations, as bare feet, minimum clothing, and wet skin reduce your body's insulation and resistance.
Do not use portable heaters in bathroom areas – use a strip heater installed high on the wall or a ceiling unit installed by a registered electrical contractor.	Never use a portable electrical appliance or place an extension cord where it could be splashed or fall into the pool.
Take extreme care when using electrical appliances near sinks, baths or swimming pools.	

Home maintenance and electricity safety

Follow these tips to ensure your safety while carrying out home maintenance.



- Keep clear of electrical wires attached to the house or shed.
- When using a metal ladder, be aware that metallic contact with the ground increases the risk of receiving a shock ensure any ladder used has rubber 'feet'.
- Ensure the flexible cord of electric hedge trimmers or electric lawn mowers is kept away from the blade. If the cord is damaged, switch the power off at the plug immediately. End users should not attempt to repair the appliance they should either dispose of it or have it repaired by a licensed electrical tradesperson.
- Energy efficiency: When purchasing household electrical appliances, end users should look for an Energy Rating Label to help them select the most efficient appliance this may assist them in reducing their electricity usage. These are designed to make the energy efficiency of a product a key feature in its selection.
- Household electrical appliances that must carry energy labels include:
 - Televisions and computer monitors
 - Refrigerators and freezers
 - Dishwashers
 - Clothes washers and dryers
 - Air-conditioners
 - Storage water heaters are also subject to Minimum Energy Performance Standards (MEPS).

Essential Safety Products

We have covered safety tips for many hazards within the home that can be avoided by taking care of visible cords and wires and mostly require human intervention. There are important electrical panel safety products, however, that are the unsung heroes of electrical safety in homes around the world.

Electrical safety should always follow the three golden rules, Protection of People, Protection of Equipment, and Protection Against Fire. Certain safety products for the electricity panel are specifically made to provide these protections.



Protection of People

The results of electric shock can range from minor discomfort to fatality. It is important to protect people when they accidentally encounter live electrical parts.

RCCB: Residual Current Circuit Breaker (RCCB) disconnects a circuit when a leakage current is detected, limiting wastage of power and protecting against electrocution. This product generally consists of a current transformer with a secondary wire which is designed to analyse the difference between phase and neutral and act accordingly.



RCCB



Protection of Equipment

We use a lot of electrical equipment/appliances in houses, like refrigerators, washing machines, TVs, sound systems, and air purifiers. These devices will work under specified voltage. Any fluctuation in voltage beyond the specified range can destroy sensitive electronic components in circuits, thereby reducing the life or damaging the equipment.

SPD: Surge Protection Device (SPD) ensures protection against a power surge. The surge protector is a kind of filter that allows safe electrical currents and prevents irregular patterns by routing them to the ground. These irregular patterns, if not filtered, can have a negative impact like burnout on electronic products. Using surge protectors can increase the life span of products.



SPD

MCB: Miniature Circuit Breakers (MCBs) are essential components of electrical systems that provide protection against short circuits or overloads. These devices are designed to interrupt the flow of electricity in a circuit when it exceeds a certain threshold, preventing damage to the circuit and the connected devices. The MCB combines magnetic and thermal mechanisms to detect and interrupt overloads. A sudden increase in current causes a magnetic field that trips the breaker, while a bimetallic strip deforms and trips the MCB when heated due to current exceeding the rated value.

MCB

UV and OV Protection: The terms UV and OV refer to Under Voltage and Overvoltage respectively. These conditions can be harmful to electronic components in circuits, potentially causing irreparable damage. To prevent such damage, UV and OV protection devices disconnect the equipment when voltage levels become unstable, ensuring that the equipment remains protected.



Electrical fires can cause huge losses, the consequence of which are far-reaching. Fire can occur due to

- Drawing more current than the specified limit (ex: drawing 15A in 10A socket)
- Unintended electrical connection between current-carrying parts
- Prolonged arc

AFDD: Arc Fault Detection Device (AFDD) offers enhanced safety for homes and buildings. AFDD mitigates the risk of electrical fires caused by electrical arcs resulting from faulty or worn electrical appliances and circuits. AFDD immediately trips as soon as it detects a potentially dangerous arc. At the same time, it is tolerant of electrical arcs caused by the normal operation of electrical devices such as switches, brushed motors, and the plugging and unplugging of devices.



AFDD



UV and OV

Additional Tip: Isolator



Schneider Electric Range of Products

Schneider Electric offers a range of RCCBs, SPDs, AFDDs, MCBs, UV/OV devices and isolator products to ensure all round electrical protection.

The Easy9 and Resi9 ranges contain circuit breakers, RCDs, switches, SPDs and comb busbars, all aimed at providing electrical protection to residential buildings. Designed with style and ease of use in mind, the ranges guarantee you have everything you need to ensure clients are happy with the result.

Acti9 Active is a family of all-in-one protection devices with in-built RCDs, MCBs and AFDDs. Thanks to in-built connectivity, Acti9 Active can send data and notifications to the cloud via our latest generation of gateways (EcoStruxure Panel Server) for remote monitoring and asset management.



Smart Home Technology and Safety

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Smart controls improve the resilience, efficiency, and personalisation of homes. They improve occupant comfort, safety, and convenience while reducing a home's environmental footprint. That alone should motivate home builders to incorporate smart solutions into their home construction plans.

In today's highly competitive homebuying market, smart technology raises real estate values and distinguishes properties. Smart devices and Internet of Things (IoT) technology, which were once considered a luxury, are now commonplace. Consumers expect them to be present in homes, especially when newly constructed.



In addition to the basic safety functionality already described, smart homes also boast energy efficiency through monitoring and control solutions to provide extra peace of mind.

According to Statista, smart home revenues have been on the rise. Smart home sales in the United States are projected to reach almost 47 billion U.S. dollars by 2025, which would be approximately twice the amount of revenue in 2020¹². In the UAE 80% of real estate investors prioritise sustainability¹³ and an independent study conducted by John Burns Real Estate Consulting found that more than 60% of new-home shoppers said they were willing to pay more for smart features.¹⁴

Solutions that advance sustainability are equally attractive to homebuyers. Such solutions ensure properties comply with environmental regulations while meeting customer demands. Schneider Electric's global consumer survey shows that 7 out of 10 consumers think it is important to lead a sustainable lifestyle.¹⁵

For home builders, smart technology and sustainability solutions are wise residential investments. If homeowners see that modern functionalities are already built into a home, they become "less price-sensitive and more excited by the new possibilities." For a small upfront investment, builders can exponentially increase their ROI.¹⁶



The Saudi government is working to ensure that 30% of all vehicles in Riyadh will be powered entirely by electricity by 2030.

The rise of e-mobility is also changing what we expect from sustainable and smart homes. As part of the Riyadh Sustainability Strategy unveiled in 2021, the Saudi government is working to ensure that 30% of all vehicles in Riyadh will be powered entirely by electricity by 2030.¹⁷ Goals such as these set the standard for EV chargers to be installed in new and old homes to ensure homeowners are able to conveniently reach their own sustainability measures. The installation of residential EV chargers comes with its own safety requirements. Electricians will need to be educated and equipped with the right tools to meet the demand. EV charging stations also need to be well taken care of and used properly, as misuse can lead to damage and even injury.

A Holistic Approach to Electrical Protection in Construction

As demonstrated through our three pillars of safety, Schneider Electric's concerns extend to both end-users and those in the development stage and ongoing maintenance of buildings: home builders, designers/architects, and electricians. Something that can't be ignored is the shift in building needs, especially surrounding sustainability. With a push toward sustainable homes and buildings, a whole new set of challenges arise. New and existing homes face different challenges in ensuring carbon emission neutrality, and in most cases, older buildings are less safe.

With innovation and sustainable technology comes new safety measures that home builders and electricians need to be aware of and need to convey to end-users.

While much of the technology required to build energy positive or more sustainable homes is already available, it is not yet in use in every home. There is a perception that resilient energy renovations are not yet accessible to all, either financially or because they appear to be too complicated. This is where home builders, architects, and designers can assist in clearly communicating the benefits and options to our clients; the only way to increase uptake is to simplify energy resilience design and renovation.

From start to finish, a holistic approach to energy system design, installation, and use is required, one that examines a home's current energy use and how well it supports the household's physical and psychological well-being and identifies opportunities for improvement. It is critical to develop a clear and simple plan for what changes to make, how to implement them, and when to do so. This necessitates viewing the home as a system and connecting all of the elements in a network so that they all work together.



Personal protection

Personal Protective Equipment (PPE) should come first over all other forms of safety gear since it immediately guards you against electrical accidents. Your probable exposure to electricity determines the level of personal protection necessary. While handling electrical items, wear electrically non-conductive gloves and shoes since they offer the utmost security. When working with wiring or when you are near electrical equipment, take extra measures, including donning a face shield, fire-resistant helmet, protective glasses, and earmuffs.

Testing equipment

Never handle any electrical equipment or wiring if you are unsure how to use it. Electrical power testing apparatus offers the required defence against unwelcome and perhaps fatal shocks. Ensure that voltage detectors, clamp meters, and receptacle testers are available on the job site.

Cord protectors

The use of secure extension cords and outlet strips is one wise electric safety move. Use cord shields and cable coverings as an added precaution. To avoid trips on the job site, use floor cable guards and make sure they are well-visible.

Precautions

To prevent electrical shock, use ground fault circuit interrupters for every receptacle outlet and identify the areas of the electrical wiring that will cause problems on construction sites.

Equipment use

For employees, using electrical devices at work may end up feeling quite normal and comfortable. This could result in inappropriate tool use or unintentional exposure to risks. This risk can be reduced by ensuring that all employees are adequately trained. In addition, make sure that everyone on the team understands how to handle each instrument safely, particularly when performing direct electrical work.

Identifying problems

You should never ignore the risks that construction sites pose. Educate your staff to get comfortable with recognising any anomaly or electrical hazard, such as a distinct burning smell. Create a safety checklist and include it in your daily schedule. Make the workplace a place where employees feel free to notify a manager of any issues.

Risk assessments

Do a thorough risk assessment before beginning any activity on the construction site. This aids in locating potential electrical risks and making sure that the right safety controls are in place to stop them from hurting workers. Familiarise yourself with the risk assessment's findings.

Compliance Considerations

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Conclusion

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Our homes are our sanctuaries, where we relax and feel safe, and where we want to invest, to feel comfortable and enjoy efficiency in the long term. Ensuring homes are safeguarded against potential dangers should be a must for all home builders, electricians, and homeowners.

Not only is it important to make homeowners aware of everyday electrical safety, home builders and electricians are in a position to stay up to date with safety measures and regulations while building and incorporating new smart home technology. With the increasing prevalence of smart appliances, systems and EV charging stations, new and improved safety measures are necessary to ensure the well-being of homeowners. Following the right safety measures could mean the difference between life and death in these rapidly changing times.

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References

- 1. https://www.iea.org/data-and-statistics
- 2. https://www.energyprofessionals.com/power-outages-on-the-rise-in-the-us/
- 3. https://www.washingtonpost.com/world/middle_east/middle-east-electricity-crisis/2021/07/23/d4dfd9f4-de74-11eb-a27f-8b294930e95b_story.html
- 4. https://www.iea.org/commentaries/working-from-home-can-save-energy-and-reduce-emissions-but-how-much
- 5. https://www.nber.org/digest/202012/working-homes-impact-electricity-use-pandemic
- 6. https://www.sciencedirect.com/science/article/pii/S1364032121001829
- 7. https://ember-climate.org/insights/research/global-electricity-mid-year-insights-2022/
- 8. https://www.telegraph.co.uk/global-health/climate-and-people/delhi-records-highest-ever-temperature-49c/

9. https://www.npr.org/2021/07/26/1020866501/record-breaking-heat-has-led-to-widespread-power-outages-in-the-middle-east

- 10. https://electrical-engineering-portal.com/short-circuit-phenomenon
- 11. https://www.chegg.com/homework-help/definitions/unsymmetrical-faults-and-symmetrical-components-4
- 12. https://www.statista.com/topics/6201/smart-home-in-the-united-states/#dossierKeyfigures

13. https://www.zawya.com/en/press-release/research-and-studies/80-of-real-estate-investors-prioritize-sustainability-in-the-uae-jbgykipw

14. https://www.builderonline.com/design/technology/for-many-builders-smart-homes-now-come-standard_o

15. The representative consumer survey was conducted by Opinium on behalf of Schneider Electric amongst 8,019 respondents across 6 markets (Australia, France, Spain, Sweden, UK and USA) in July 2021. All surveys were conducted in respondents' native language, with translations provided by a professional translation company.

16. http://www.pert.me/blog/why-builders-construction-businesses-in-india-are-turning-towards-smart-homes/

17. https://www.arabnews.com/node/1953596/business-economy