



# Safety services

Personnel risk prevention



- Maximum protection
- Maximum uptime
- Maximum peace of mind



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**ABB offers a wide range of solutions to prevent and mitigate installed base failure events, enhancing safety for personnel risk prevention, minimizing damage and reducing downtime.**

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# Putting the protection of your people first is a smart choice.

Safety is not a cost. It is an investment.

Safety should be a priority for every business. Safety upgrade solutions are essential not only because they save lives, but because investing in the right precautions today can save you time and money in the future. There is a real business case for personal risk prevention to protect people and assets, reduce the cost of injuries and damages as well as to limit downtime and maintenance requirements.

At ABB, we are proud that our wide range of solutions go above and beyond standard regulation compliance to bring you the best possible value. Our portfolio offers:

**Maximum protection.** Look after your people with reliable ABB future-ready arc flash mitigation solutions that offer fast response times and greater protection than required by current regulations. Innovative features such as remote condition monitoring lower risk by reducing the interaction of personnel and equipment. Installed base condition assessment, operator training and remote operating controls reduce dangerous man-equipment interactions and opportunities for human error, improving overall safety and productivity at lower operating cost.

**Maximum uptime.** ABB arc flash mitigation solutions keep your business running, improving uptime by limiting the energy of arc faults, therefore limiting the damage they cause to switchgear and assets and the repair time required. Monitoring & Diagnostic, Condition Based and Predictive maintenance solutions ensure regular downtime is kept to a minimum reducing the likelihood of unexpected failure during operation.

**Maximum peace of mind.** You can count on ABB. We are certain to have a high-quality solution that's right for you – from low- to medium-voltage applications. With more than 100 years of experience in power and automation, we are the trusted partner of businesses worldwide.



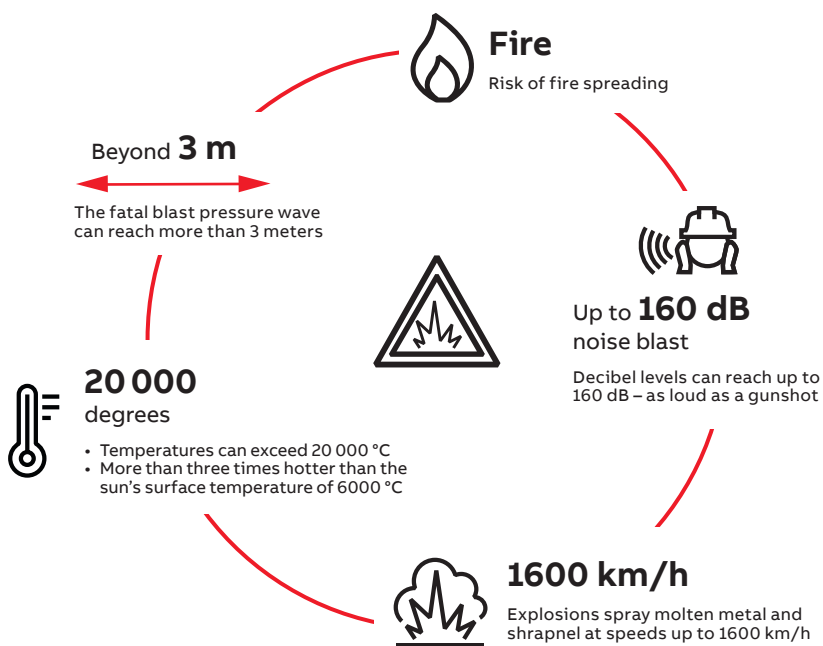


# ABB's formula for safety

## What is an arc flash? And how can it be avoided?

There are rare cases where failure inside a switchgear cabinet, due to a defect, exceptional service condition or incorrect operation can cause an internal arc — a short circuit current flowing through the air, also called arc-flash. This can create a significant hazard due to the instantaneous increase in temperatures at the fault location well above the melting point of steel, copper and insulation materials. Internal components are vaporized and the sudden release of heat and plasma (ionized gas) creates an explosive blast

### Arc flash dangers



Maximum protection of all personnel during an arc-fault is of course the number one priority. Approximately 75% of the internal arcs occur with an operator working at or standing in front of the switchgear. On internal arc classified (IAC) switchgear, personal protection is fully accomplished by an integrated pressure relief system. Regarding non-IAC switchgear, this passive protection is not given in full respect since heat and plasma can escape, normally at the weakest point of the switchgear which in many cases happens to be the door. This significantly reduces personal safety on site.

Passive protection can increase personal safety, but it is advisable to take active measures to prevent such an event from happening in the first place. This not only eliminates risk to people, but also offers protection against damage and even destruction of system components. The consequential production outage of the plant often results in higher costs than the damaged switchgear. Employee safety and reliable personnel risk prevention are the highest aims for ABB.

For this reason, ABB provides a wide range of offerings to help its customers to address all safety elements.

Learn more

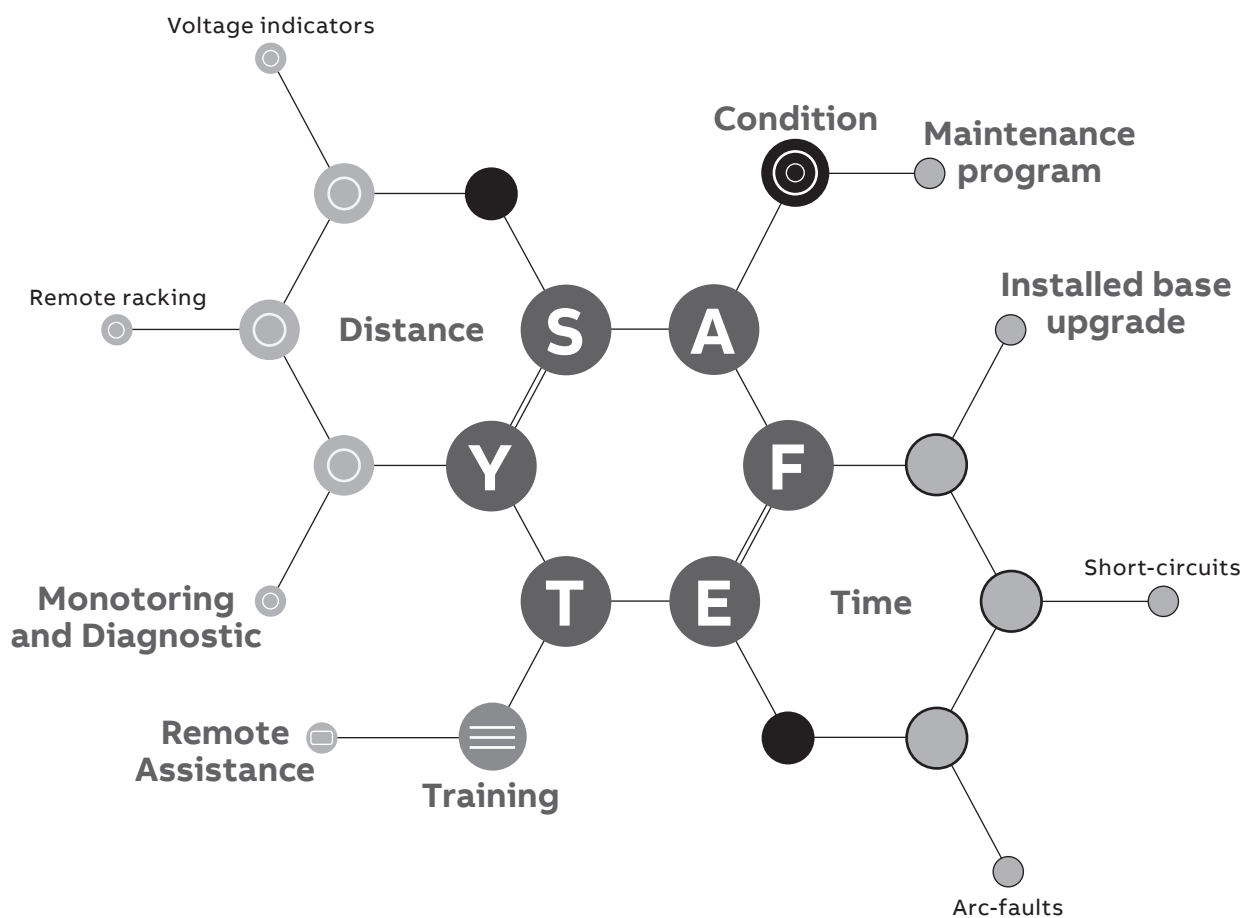
[15 steps to prevent arch flash accidents](#)

# ABB's formula for safety

## Practical safety measures against electrical hazards



In the face of fault risk present in low and medium voltage switchgear, prevent accidents to protect the personnel and the electric installation itself by following this proven formula.





#### Condition

Knowing and improving the condition of the equipment is a key factor in reducing the likelihood of failure, damage and injury



#### Training

Adequately trained personnel and proper procedures are essential to safe operations



#### Maintenance program

A correct and periodic maintenance, based on the actual conditions of the equipment, is essential to reduce the likelihood of failure



#### Remote Assistance for electrical systems - RAISE

Augmented reality bringing ABB expertise and knowledge when and where you need it, increasing safety of operations



#### Distance

Maintaining a safe distance between personnel and equipment during critical operations provides the most effective means of avoiding injury by keeping people out of harm's way



#### Time

Reduction of time for clearing fault conditions has a dramatic impact on the energy released and consequent damage and injury.



#### Monitoring and Diagnostic

Asset health monitoring provides end users with peace of mind that the equipment will perform as required, when required, proactively maintain equipment only when needed



#### Installed base upgrade

Replacing phased-out devices with circuit breakers from the current production range specifically designed to mechanically and electrically adapt to the installed base provides a substantial improvement in reliability, safety, maintenance needs and performance



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## Condition

Knowing and improving the condition of equipment is a key factor in reducing the likelihood of failure, damage and injury.

ABB has various options available to improve the condition of switchgear:

- Asset risk assessments to establish the risk profile of equipment based on its condition and importance in the system and prioritize actions to mitigate the risk before the hazard occurs.
- Risk monitoring and mitigation programs to maximize improved reliability and reduced operator exposure.
- Equipment upgrades and retrofit which decrease operator exposure because of reduced maintenance, faster cycle times, and lower clearing times.
- Diagnostic testing to address concerns of bad connections, pollution, mechanical faults and minimize failures due to defective devices.



MySiteCondition supports finding the most appropriate business decisions related to the allocation of the operational budget. This is possible by strategically directing funds on an asset risk condition basis to move from time-based towards advanced maintenance methodologies.



01

01 MySiteCondition asset risk chart and project menu on tablet/ smartphone App

Learn more

[MySiteCondition](#)

## Monitoring and Diagnostic

Accurately determine the most cost-effective course of action with an intelligence-based service; asset management that prioritizes the right actions at the right time.

Asset health monitoring of critical assets within the electrical distribution network provides end users with peace of mind that the equipment will perform as required, when required. It is also used to proactively maintain equipment only when needed, reducing maintenance costs and operator exposure to energized equipment.

Any new or existing panel can become truly ABB digital compliant by having SWICOM onboard, regardless of age, design or brand. One unit covers information from the whole switchgear lineup.

SWICOM is a monitoring and diagnostic unit which provides mechanical and electrical health status of a fleet lineup. It acquires data communicating with IEC 61850 based protection relays on circuit breakers performances and via sensor bus of additional sensors, such as temperature, humidity, partial discharge sensors, to have further asset information, and converts the data to diagnostic information. One SWICOM unit handles a whole switchgear lineup and can be installed on both ABB and non-ABB assets.

SWICOM monitors the following variables:

- Operation of the mechanical part: opening and closing times, spring charging time, slipping and failed spring charging attempt, number of operations, idle time
- Remaining life estimation and contact wear
- Ambient temperature and humidity of the installation area
- Temperatures in critical points on primary circuit
- Switchgear Partial discharge presence indicator PDCOM

Assets condition is visible on site via a touch HMI. A mobile app provides data via smart devices, while SCADA connection through Ethernet TCP/IP is possible.







SWICOM connects to the ABB Ability Asset Manager cloud-based dashboard showing the asset health status remotely.

ABB Ability Asset Manager enables ABB service engineers and operations teams to deploy continuous monitoring of remote assets such as switchgear and circuit breakers performance trends, evaluates events, alarms and trips for specific maintenance and essential issues to define the correct maintenance procedures at the right time. It replaces conventional maintenance approaches with condition-based services that lower the risk of unexpected equipment faults.

## Monitoring and Diagnostic

Accurately determine the most cost-effective course of action with an intelligence-based service; asset management that prioritizes the right actions at the right time.

Hot spot detection in switchgears is one of the most crucial condition monitoring functionalities as temperature of the primary circuits has a dominant influence on the switchgear insulation life. ABB's approach provides high-level performances with a lean hardware and software structure. It allows for early fault detection preventing insulation deterioration and lowering risks of insulation faults.

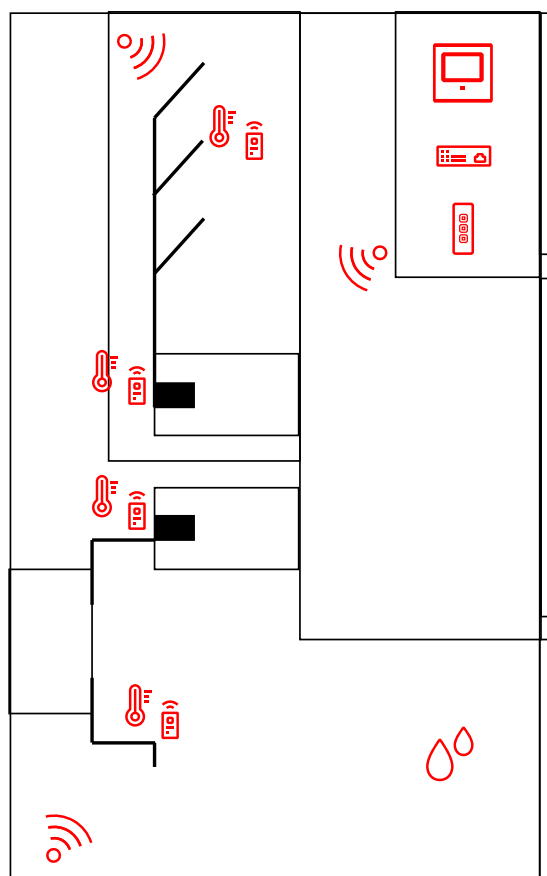
- Online continuous monitoring is an improvement over traditional Infrared (IR) thermal measurements done on scheduled intervals through dedicated arc-proof ports with closed compartment doors by periodic thermo-graphic inspection, limited to specific critical areas (e.g. power cables connections).
- SAW temperature sensors used for online continuous monitoring are wireless passive components directly coupled to the conductors, with no battery or power source required and a very long service life in the switchgear environment. Typically, up to 12 sensor per feeder can be deployed to monitor continuously all possible switchgear joints and circuit breaker disconnectors, thus providing an efficient method for preventing hot spots and associated faults.
- Partial discharge (PD) level sensing is a well-known method for detecting insulation degradation processes before real insulation failure develops. The assessment results are documented as trend curves and KPIs for each switchgear, where high increase of partial discharge activity level is processed by PDCOM and SWICOM diagnostic analytics to indicate high risk of insulation failure. Continuous monitoring by PDCOM PD indicator sensor replaces time-based PD assessment inspections that may not detect critical conditions due to PDs erratic behavior, often related to environmental and switchgear operating conditions.







PDCOM Partial discharge (PD) level indicator supports detecting insulation degradation processes before real insulation failure develops.



PDCOM is capacitively coupled to switchgear bus by existing voltage indication system, thus limiting modification to installed base and can effectively monitor up to 10 switchgear columns in a busbar, providing PD presence detection and analytics for remote condition assessment.

SWICOM is a fully integrated monitoring solution providing detailed analysis of switchgear health situation and early warnings about developing issues.



-  SAW sensors (one per phase)
-  Humidity sensor
-  Antenna for SAW sensors (two antennas per compartment)
-  Transceiver /data-card
-  PDCOM
-  SWICOM

Learn more

[MV condition monitoring - SWICOM](#)

[LV condition monitoring - CMES](#)



# Maintenance Program

## SWAPs Maintenance program for successful and lasting use of your assets

Performing a correct and periodic maintenance, based on the actual conditions of the equipment, is essential to reduce the likelihood of failure and ensure safe operations, protecting both people and the equipment.

SWAPs is a maintenance program which provides schedule and content directly through a web-tool, tuned on specifically entered conditions. It is based on 5 levels of maintenance (See, Watch, Act, Perform, Secure), where intervals are defined according to the assessment of the equipment environmental and operational conditions, age, previous maintenance performed, and presence of monitoring and diagnostic solutions. The schedule continues until the equipment reaches its end of life, also recommending the right time for relay and circuit breaker retrofit.

The levels See, Watch and Act can be carried out by customer's appropriately trained personnel, while Perform and Secure require ABB field engineers due to the expertise and product knowledge required for the specific activities.

The environmental and operational parameters are defined by IEC, IEEE and GB Standards and by ABB experience.

The related conditions are divided into three classes:

- Normal condition - as defined by international Standards (IEEE, IEC, GB)
- Optimal condition - is the favorable range within the normal conditions, based on ABB experience
- Severe condition - is outside the normal condition and can cause premature aging and wearing, leading to higher safety risks and probability of failure.

Optimal conditions allow the increase of maintenance intervals by 30%, while severe ones imply their reduction by 50%. Monitoring and diagnostic solutions also affect the plan, as they allow to extend maintenance intervals by 30%, irrespectively of the conditions.



**Trained personnel**  
Dedicated ABB maintenance trainings



**ABB certified technician**

SEE	WATCH	ACT	PERFORM	SECURE
Overall visual inspection	In-depth inspection (de-energized panel)	Cleaning, lubrication and functional testing of the equipment	In-depth analysis of the asset and immediate corrective actions	Special maintenance for critical situations

**Learn more**

[SWAPs Maintenance Program](#)

## Distance

Remote operation and racking provide a safer operating environment for personnel

Remote operation provides a safer operating environment for personnel through the proven method of adding distance between the operator and arc flash incident energy at the switchgear site, bringing operation of power circuit breakers to a new level of safety.



External remote racking allows withdrawable circuit breakers to be remotely racked in and out from a safe distance. It is a cost-effective way to attain a new level of operator safety since a single portable device is used for the whole line up, representing an optimal solution when apparatus is seldom racked.

Remote racking by TruckMaster (MV) and RRD (LV) provide a safer racking operation by applying a portable external driver to existing or new switchgear, as well as to conversion and roll-in replacement solutions.

The device can be simply and rapidly applied to the circuit breaker or to the compartment door and is the most effective way to ensure that operators work in total safety. Racking operations are performed by applying the recommended force, thereby preventing damage to the mechanism and interlocks.



Learn more

[TruckMaster - Enhanced personnel safety](#)  
[RRD Remote Racking Device](#)

## Distance

# Remote operation and racking provide a safer operating environment for personnel

Onboard remote racking is an available option for new circuit breakers and contactors. It can also be integrated into hard-bus and cradle-in-cradle retrofit applications for installed base safety upgrade.

Embedding a motor operated racking system onboard each new or retrofit breaker makes the remote racking function immediately available and it is suggested for often operated applications or for racking from a control center. This feature is available also for some Roll-in-Retrofit solutions for legacy ABB circuit breakers.

Maintaining a safe distance between personnel and equipment during critical operations provides the most effective means of avoiding injury by keeping people out of harm's way

Enhanced switchgear operability preventing human errors can be achieved by remote racking devices and remote operation by plant supervision. Electrical maintenance, trouble-shooting personnel and operators are always exposed to risks when working in the switchgear room. Maintaining a safe distance between personnel and equipment during operations provides the most effective means of avoiding injury.



### Maintaining a safe distance

The installation of voltage indicators on accessible power circuits can increase the operator's safety and avoid accidental electrical contact injuries. VisiVolt is an ABB passive voltage indicator perfectly suiting the equipment upgrade, it neither employs any electronic circuit nor needs any power supply, what makes it a robust and durable device.

It is adapted for permanent installation on busbar and naked or insulated metal conductors, indicates the presence of voltage by displaying a large and well visible lightning arrow sign on its display. The silicone elastomeric enclosure ensures performance also in outdoor conditions while its fluorescent orange color provides good visibility among the other elements of the system.

Applied to the conductors it stands with its highly visible indication as last warning to operators on high potential parts they may accidentally access to when interlocking and barriers may have failed.

Learn more

[VisiVolt](#)  
[OneFit Safety Plus](#)





# Time

## Milliseconds that count

The occurrence of an arc fault is the most serious fault within a power system. ABB solutions limit the arc incident energy, the amount of thermal energy generated during an electric arc event, and consequently limit the damage to the equipment.

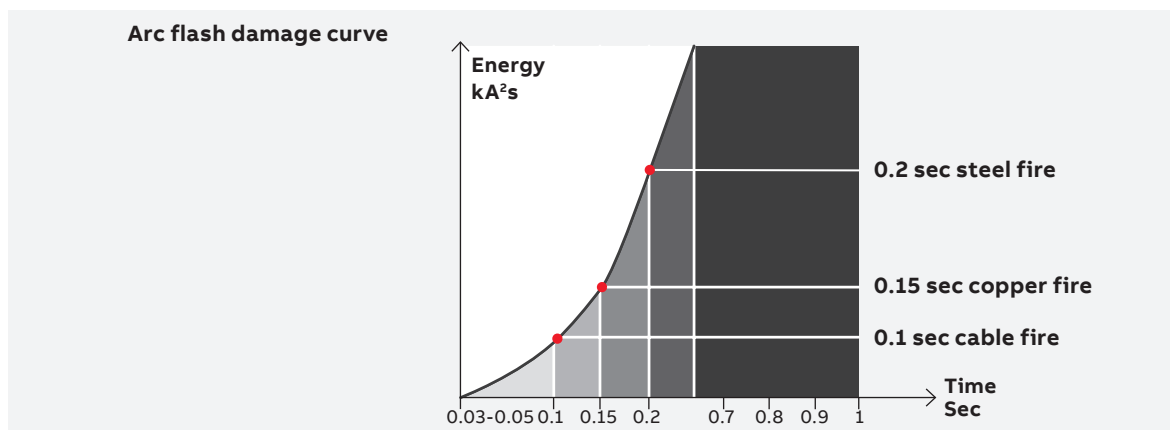
Modern switchgear offers complete passive type tested protection against the effects of a fault due to an internal arc for a time of 1 second up to 50 kA. ABB has also developed excellent active protection systems which allow very important objectives to be achieved:

- Detection and extinction of the fault, in 100 ms or less, which improves network stability
- Limitation of damage on the apparatus
- Limitation of outage time for the switchgear
- Limitation of effects outside the switchgear, if not internal arc classified, and risks for personnel

The main parameter of the electric arc, which characterizes its destructive ability, is incident energy. This is directly proportional to the arc duration and arc current. Reduction of the current or of time for clearing fault conditions has a dramatic impact on the energy released and consequent costly equipment damages, long outages and potential injury.

The arcing fault is usually interrupted by a circuit breaker and relay/trip unit or fuses. For active protection against an internal arc, ABB solutions consisting of various types of sensors, using the pressure or light generated by the arc fault as trigger, installed in the various compartments, which detect the immediate outburst of the fault and carry out selective tripping of the circuit breakers or even faster action by Ultra Fast Earthing Switch, UFES.

Without any active arc flash mitigation solutions in place, the arc clearing time (which is the total time between the beginning of a specified overcurrent and the final interruption of the circuit) may vary from 0.2 to 0.4 seconds. However, within this short time, steel, copper and cable can burn, melt and vaporize, as shown in the diagram.



# Time

## Milliseconds that count

### Reducing the arc clearing time

In order to reduce the negative effects of an arc event, the arc clearing time must be reduced. This is the role of active arc flash mitigation solutions.

The following methods and technologies are available:

- **Energy-reducing maintenance switch.** Limits the duration of the fault current by temporarily lowering the trip threshold of the circuit breaker. Available in LV and MV relays as alternative settings group (dual settings) or RELT function it lowers trip protection thresholds and time delays to instantaneous when activated by personnel presence in the switch room, dramatically reducing the impact of an arc flash event.
- **Optical-based internal arc-detection devices.** Relays that detect the arc flash light and current (optional). When the arc flash is detected, it sends the tripping signal to the circuit breaker. Arc detection electronic monitoring device is located in the low voltage compartment and it is connected to optic sensors. These are distributed in the power compartments and are connected to the device by means of optic fibers. When a certain pre-set light level is exceeded, the device opens the circuit breakers.

To prevent the system from intervening due to light occasionally generated by external phenomena (flash of a camera, reflections of external lights, etc.), current transformers can also be connected to the monitoring device, tripping the circuit breaker only if both light and short-circuit current signal are simultaneous. It is possible to create customized solutions with selective tripping.

Relion IEDs, (Intelligent Electronic Device) can optionally be fitted with a fast and selective arc flash protection. It offers a three to six channel arcflash protection system for arc flash supervision of the circuit breaker, cable and busbar compartment of switchgear panels.

- **Arc quenching system.** Equipment that provides a lower impedance current path after it has detected an internal arc fault in order to cause the arcing current to transfer to the new current path, ultra-fast earthing switch UFES provides detection and grounding of faults in times significantly faster than breaker clearing 20 times faster than standard arc protection, leads to a total arc clearing time less than 4ms, with a significant reduction of overpressure and toxic gases release and a tremendous reduction of downtime and repair costs.
- **Combination of arc quenching system with current-limiting fuses.** UFES used in combination with current-limiting fuses for an extremely fast fault clearing.

Learn more

[Arc flash protection and mitigation](#)  
[Evaluate the risk of arc faults in your installation](#)  
[Smarter Safety: IEC arc flash mitigation solutions](#)

### Reducing the current

The IS-limiter™ and FC-Protector® can be used in various applications providing very high and fast fault current breaking capability at high operating currents.

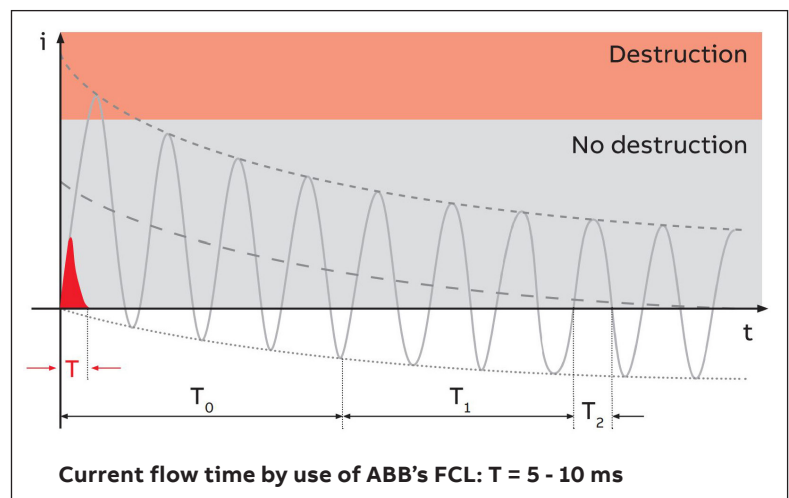
They are commonly used in applications to connect two independent systems or an additional power source, such as a generator or grid connection, to limit short circuit current reached to a level that breakers and buses can withstand, protecting property and personnel.

While the main use is to ensure the permissible short circuit capability of the equipment in an electrical network will not be exceeded, the fast intervention time and limiting effect enables to reduce the consequences of an internal arc too, by decoupling one source within less than few ms.

The lower current from one source only will still supply the fault and potentially an internal arc until cleared by a standard circuit breaker or by an active arc flash mitigation solution.

### ABB's fault current limiters

disconnect the fault affected part of the system extremely fast so that the short-circuit contribution to the Internal Arc is strongly limited, if not cleared.



# Installed base upgrade

## Add 20 years to the lifetime of your switchgear

Safety aspects linked to obsolete switching technologies need consideration and can be a driving element when deciding for installed base modernization.

The most relevant safety risks include:

- Fire and explosion hazard: bulk oil and minimum oil CBs; used mineral oil as insulation and interruption means; in the event of failure this can greatly increase the consequences of a fire;
- Asbestos: air magnetic circuit breakers used such insulating material in the interrupting chambers; while typically stable in operation, it can be released during the circuit breaker arcing-chambers maintenance posing health risk for operators and requiring a specific risk assessment and procedures;
- Missing interlocks and segregation barriers to high potential parts when opening the switchgear doors and removing the original switching device in obsolete switchgear posing electrocution risks;
- Original switchgear operation mode is brand and model specific and may not be known to new personnel due to seldom operation or lack of specific training, it poses risks under emergency or unplanned operation
- Non internal arc (IA) resistant switchgear construction and missing arc gas ducts.

Switchgear modernization with the latest breaker and relay retrofit technology minimize transformation and loss of production time, reduce investment costs by avoiding station cabling and civil works.

Modernize switchgear with the latest retrofit technology to improve safety and performance, the roll-in replacement circuit breaker is a completely new device built around a modern circuit breaker.

Risk mitigation strategies introduced during the modernization process can reduce the internal arc energy released with active fault detection protections, faster operation or maintenance dual settings or can provide a safe operating distance to personnel by remote racking and operation.



Retrofill is a switchgear modernization process that includes the replacement of the original circuit breaker with a standard withdrawable circuit breaker by installing in the existing switchgear a fixed frame that provides the new circuit breaker interface.

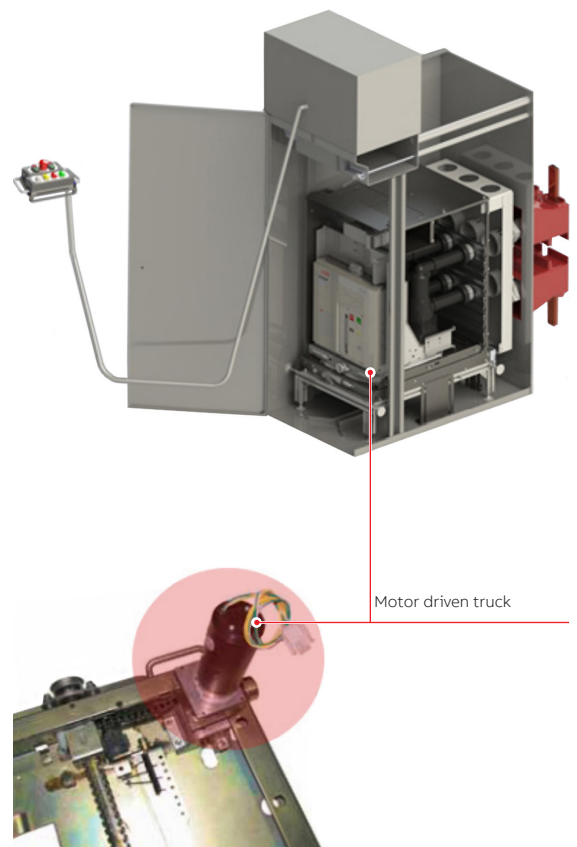
Such a solution is applicable when the existing switchgear is in serviceable condition. It can greatly upgrade the switchgear safety performances as it replaces a significant number of the original panel parts, like the shutter and shutter operation system and all relevant interlocks in addition to the circuit breaker.

OneFit is ABB's hard-bus retro-fill design concept, containing an integrally safe plug-in technology. It easily connects the new breaker to any existing panel, providing an effective modernization and safety upgrade of installed base.

OneFit is the true retrofill solution providing new apparatus racking system, integrated metallic isolating shutter and state of the art interlocking system. The OneFit range is composed of different solutions representing an increase in safety for personnel and switchgear renewal.

The Safety package is the basic OneFit solution, providing closed door operational mode, avoiding accidental electrical contact injuries and increasing personnel protection.

The safety Plus OneFit package supports integration of motor operated racking system (truck motorization) on each new circuit breaker when frequent operations are required.





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# Training

Adequately trained personnel are essential to safe operations

Trained personnel with high expertise allow safe, correct and reliable operation and reduce downtime. Learn via your own site, in the classroom or online.

## Why train with ABB?

- **Training engineering and technical services** provide personnel with a better understanding of their equipment and systems and the safest means to operate them
- **Arc flash studies** help to determine the necessary level of protective equipment or clothing to be worn by workers near potential arcs and help determine the proper application of any arc flash mitigation equipment to be installed
- **Engineering studies** determine the proper settings and system coordination, while addressing the speed of the system to handle a fault so relays and associated protective devices are set properly for the system to react as designed

We work in partnership with you to address your specific needs and ensure that your personnel are more satisfied with their jobs thanks to deeper knowledge of equipment, covering safety procedures, correct product operation, routine maintenance and service procedures, basic fault finding.

## Learn more

[Medium Voltage Training](#)

[Low Voltage Training](#)



# Remote Assistance for electrical systems - RAISE

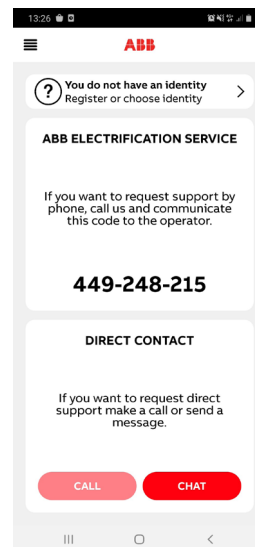
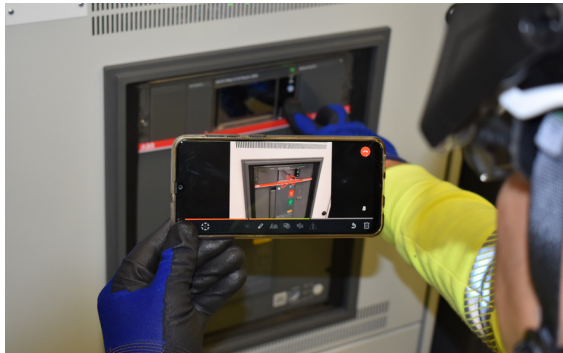
Augmented reality bringing ABB expertise and knowledge when and where you need it, increasing safety of operations

Remote Assistance for electrical systems (RAISE) is a service remotely provided that enables ABB Experts to guide field operators, placing augmented reality (AR) instructions into their field of view, sharing images, videos and documents on their own devices such as smartphones, tablets or supported wearables.

RAISE enables flexible, easy, fast real-time remote support, connecting a Field Operator with an ABB Expert, thereby reducing time to resolution and

optimizing maintenance through existing resources. This allows to improve safety, as the Field Operator is guided by the ABB Expert, as well as the productivity and reliability of the electrical system.

The solution also brings improvement of first time fix rate and MTTR, Mean Time To Repair - thanks to the prior knowledge of conditions on site, and reduction of costs and CO2 emissions through a reduction in required air/road travel.



Learn more

[Remote Assistance for electrical systems - RAISE](#)

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[abb.com/lowvoltage](http://abb.com/lowvoltage)



[abb.com/mediumvoltage](http://abb.com/mediumvoltage)



[solutions.abb/abb-ability-electrification](http://solutions.abb/abb-ability-electrification)



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